FOOD SERVICE PROCEDURES
in
FALLOUT SHELTERS

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THE DEPARTMENT OF DEFENSE

A RESEARCH STUDY

OF

FOOD SERVICE PROCEDURES

IN

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CONTENTS:

FOREWORD

This report was designed to describe optimum food service procedures for fallout shelters. It presents the purposes, responsibilities, policies and operations of the person selected to manage these services under the overall supervision of the shelter manager.

It is the aim of the report to present workable solutions to the many problems that could arise and to suggest and explain minimum equipment needs. The elaboration of facilities which could be employed to make the shelters even more habitable have been studiously avoided in the interest of economy and space.

The chief emphasis has been placed on equipment and supplies for existing structures licensed as fallout shelters, but the basic principles and procedures will apply to other community or private shelters. No consideration has been given to situations resulting from direct bomb destruction, fire, storms, or other types of disaster.

As far as possible, alternative solutions are presented. An attempt has been made to explain and expose any risks that might arise and offer bases for judgments to be exercised in their solution by management. In some instances, too little exact technical information is available and educated choices will need to be made. Every effort has been made to further safe prediction under these conditions.

Working under the assumption that intelligent and cooperative planning and management of shelters can save the lives of a high percentage of the population of the community, pertinent information

and experiences relating to food services in previous disaster situations have been assembled and reviewed for this report. In addition to this literature, the research in foods, the experiments with simulated shelter management, and the contributions of psychology as well as Civil Defense publications have been studied. An analysis of these experiences has borne out the assumption that the management of limited supplies of water and food was usually the crucial problem in survival.

Attention has been given to the fact that the management of the shelter will depend entirely upon local talent and cooperation and that no previous experience or dress rehearsal is possible.

As much detail as possible has, therefore, been described for all basic shelter operations, even though it is understood that no two shelters will be alike.

Unless the nuclear disaster is so devastating and bewildering that the population is incapable of its usual adaptive behavior and willingness to cooperate, in our opinion, competent water and food management should be able to guide most of the people through a shelter experience.

As this study progressed, it became increasingly clear that the food manager and his staff, as volunteer workers, would need detailed guidance and training to do a satisfactory job under such adverse conditions. For this reason, much of the material of the report has been reorganized in two training manuals entitled:

I. A Manual for Food Managers in Licensed Shelters, and

II. A Guide for Training Food Managers in Licensed Shelters.

INTRODUCTION

1. Scope of Report

~~This report is~~ a study of the management problems involved in the procurement, storage, preparation and service of water and food in fallout shelters having a capacity of 50 or more occupants.

Particular attention is given to the nature, composition, quality, quantity and variety of foods capable of being easily stored, prepared and apportioned under emergency conditions at minimum cost. ~~It~~ is not, however, confined to this phase of shelter management alone, since other factors may limit or alter planned food operational procedures which are essentially interdependent, such as ventilation, temperature, and sanitation.

2. Methods of Study

The methods of study used throughout the report will be essentially comparative. A standard public shelter stocked with Civil Defense rations only will be compared with semi-public shelters where these rations will be supplemented with approved water and food provided by the occupants or other sources.

Other variables providing for comparative analysis are the types of shelters, the protection offered, the capacity of the shelter, provisions for ventilation, the nature of the population to be served and the equipment and fuels available.

3. Shelter Objectives

The primary objective of the national fallout shelter program may be simply stated in a single word - survival.

The problem of survival in a nuclear situation, however, cannot be as simply resolved. Nuclear testing has shown that all life within a measurable area circumscribing the target point will be obliterated by the blast and thermal effects of the atomic detonation.

Fringe area survival is a matter of degree and is dependent upon such factors as the terrain, building construction, and the height of the detonation of the atomic device.

These initial effects, devastating as they may be, are lethal only within a comparatively few miles. The gravest danger to the greatest number of people is radioactive fallout.

Other than evacuation, the only defense against the resulting radiation sickness and death is shielding. Herein lies the necessity for a fallout shelter program.

With adequate protection from fallout provided for by shielding, the necessities for human survival in a fallout shelter are basically the following:

a. Air
b. Water
c. Food
d. Effective temperature control
e. Space
f. Maintenance of health
g. Management

4. Factors Influencing Management Planning

Fortunately, the minimum standards for sustaining human life have been generally established. With this knowledge, a plan may be prepared for the maintenance of a given number of people confined within a given space for a given length of time. With proper equipment and adequate power, ventilation and temperature may be controlled. With pre-planning and pre-stocking, shelter living for limited periods of time under controlled conditions presents few physiological hardships.

In reality, however, shelter living has an uniqueness incomparable to any other known situation, simply because no such conditions have existed before.

However carefully the shelter management program is planned, the unknown, unpredictable factors will necessitate many adjustments, since the majority of these variables are impossible, or in the least, difficult to determine in advance of the actual situation.

Such factors include:

a. The problem of overcrowding
b. The length of stay
c. The temperature and weather conditions outside the shelter
d. The age distribution of the occupants
e. The physical condition of the occupants
f. The psychological attitude (morale) of the occupants
g. The amount of pre-training of management
h. The degree of devastation of the local area
i. The adequacy of communication with the outside world
j. The awareness of the total problem
k. Possible health and sanitation problems resulting from sewer back-up, flooding, or water seepage.
l. Epidemics

In as far as space permits, attention is given to possible maladjustments arising from one or more of these factors in the shelter.

5. General Assumptions

This report, of necessity, must deal in generalities, recognizing that precise statements are particular to a situation. On the other hand, certain basic assumptions had to be recognized before a systematic study could proceed. The more important assumptions are indicated below:

a. The shelter plant considered in this discussion must meet the requirements as described by the National Fallout Shelter Survey, Marking and Stocking Program which are:

(1) It must have a protection factor of 40 or more

(2) It must have a capacity of 50 or more

(3) It must be habitable with adequate ventilation.

(4) It must have storage space of at least one cubic foot per occupant.

See appendix F

Our first assumption, then, is that the shelter plant must meet the above minimum standards.

b. Very few of the designated shelters throughout the nation will have a satisfactory ventilation system.

Since temperatures must be kept within habitable limits, this problem is closely related to food preparation and had to be carefully considered.

c. It was assumed that only one nuclear attack would occur, so that the confinement period in the shelter could be expected to require not more than 14 days provisions.

d. In procuring and storing food, the amount necessary to sustain the body and the morale of the occupants was the basic criterion of selection. Other characteristics considered in the report are shelter life, palatability, relative economy, difficulty of preparation, caloric balance, resistance to water, liquid content and the nature of the containers.

e. A public shelter is essentially a subdivision of the community and must be governed. The nature of the problems indicate the need for a strong organization with able management.

f. A strong central organization assumes pre-shelter selection, training and planning of staff together with a management manual describing details of operation.

g. Authority in the shelter must be delegated and maintained. Democratic procedures should be used when possible. An advisory committee should be selected from the occupants to advise with the managers.

h. General policies for the administration of the staff and the distribution of water and food should be carefully prepared and approved as ground rules for the food manager.

i. The food manager should plan instruction on contaminated food for the occupants before they are released to provide for themselves in the post-shelter period.

6. Shelter Classification

Shelters may be classified in a variety of ways. In this report reference is made to a classification based on survival potential and that used by the Civil Defense based on licensing and the nature of control. The accompanying tables show the classes.

Any fallout shelter differs from any other shelter as the following variables differ:

a. Physical plant - single unit below ground, single unit above ground, basement or sub-basement, and inner or core concept type.
b. Protection factor
c. Capacity
d. Authority and management - federal, local, industrial, private
e. Ventilation - natural or artificial
f. Population - age distribution, background, sex mix
g. Food stocks - austere, supplementary, near-normal.

In attempting to classify existing shelters for study purposes, the following assumptions have been made:

a. Item a above is of no consequence except that within an existing structure, the protection factor varies.
b. The protection factor of 40 is assumed to be adequate.
c. The capacity shall be correlated to the ventilation requirements and determined in advance.
d. The occupants of the shelters discussed will be from a cross section of the population. See appendix B

e. Three types of shelter food stocks will be considered: basic federal rations consisting of survival biscuits and water, spread-supplemented, and near-normal.

Shelters may be classified as to the following definitions:

a. The private shelter is one that has been built and financed by an individual or group, such as a family shelter or one within an office building. It may be a basement or portion of the core of a building or a separate entity, either connecting with another building or standing alone, above or below ground. It is assumed that the protection factor is adequate and that provision has been made for adequate ventilation according to the planned capacity. It will be stocked with food and equipped according to dictates of the owner or owners.

b. A community shelter is one provided by local authorities and having no federal requirements with which to meet. In the barest sense, it may provide shielding from residual radiation only and may or may not be stocked with food and equipment. Local authorities would determine what to stock and how far to go in equipment.

c. A public shelter is one that has been properly licensed under the National Fallout Shelter Program according to specifications set by the Department of Defense. Its capacity will have been determined according to space and ventilation standards and it will have been stocked with austere rations of 14 quarts of water and 10,000 calories per person for a two-week period. Its management and authority will be the responsibility of the local Civil Defense office.

d. A semi-public shelter is a licensed public shelter with space preference granted, by local Civil Defense authority, to occupants of the building. Any remaining space is then

opened to the public. It is envisioned that food and equipment stocked by D. O. D. would be supplemented by the licensee, limited only by space and finances.

Other shelter definitions and terms include:

a. A dual-purpose or integrated shelter is one having a specific peace-time use but may be easily converted into a fallout shelter if necessary.

b. A designed shelter is a structure that has been expressly built for use as a fallout shelter.

c. A designated shelter applies to one licensed and marked under the National Fallout Shelter Program.

d. A control center shelter is a fallout shelter built with public funds for use as an operational center in time of emergency for Civil Defense and governmental officials and staffs.

Additional classification information may be found in Exhibit I-1 and Exhibit I-2.

EXHIBIT I-1.

SHELTER CLASSIFICATIONS AND SURVIVAL POTENTIAL *

SHELTER CLASS	PROTECTION FACTOR	SHELTER EXAMPLE	FALLOUT DISPOSITION HEAVY	MEDIUM	LIGHT
1	20-39	basements of small bldgs., central areas, upper floors of large bldgs.	poor	fair	good
2	40-69	as above.	poor	fair	good
3	70-99	OCDM basement fallout shelters	fair	good	good
4	100-149	as above.	fair	good	exc.
5	150-249	central areas of basements of large bldgs. with some exposed walls	fair	good	exc.
6	250-500	basements of large bldgs. with no exposed walls	good	exc.	exc.
7	500-1000	as above	good	exc.	exc.
8	1000 up	underground installations, mines, tunnels, etc.	exc.	exc.	exc.

* National Plan Appendix Series - Guide for Executives. N P - 10 - 1

EXHIBIT I - 2

SHELTER CLASSIFICATIONS

	Non-Licensed Non-Designated		Licensed Designated	
Funds	Community Multiple	Private Individual	Public Federal	Semi-Public Federal + Multiple or Individual
Licensed and Approved	No	No	Yes	Yes
Communication by D. C. D.	No	No	Yes	Yes
Stocked - 14 qts. H_2O + 10,000 calories	No	No	Yes	Yes
Occupants preferred	No	Yes	No	Yes
Management	Any	Any	D. O. D.	D. O. D.
Additional Stocking Possible	Yes	Yes	No	Yes
Private Money	Yes	Yes	No	Yes
Additional Equipment Possible	Yes	Yes	No	Yes

Community shelters, when surveyed, marked, stocked, and licensed according to federal standards, are expected to provide shelter space for about 60 million Americans. Most, if not all, of this space will be in existing buildings which were not specifically designed as fallout shelters. It is conceivable that a portion of these structures may have a high protection factor while adjacent areas offer a lesser degree of protection. The potential problem of overcrowding within the main area, or core, of a building may be partially remedied by moving some of the shelter occupants to these adjacent areas as soon as the initial high level of radiation has diminished.

For shelter survey purposes, structures have been classified according to their protection factors. Eight categories of protection, together with examples of potential shelter areas and the survival probability of each, are listed in Exhibit I - 1. Only shelters having a protection factor of 40 or more will be licensed by Civil Defense.

The second requirement for licensing is that the shelter must have a capacity of at least 50 occupants. The population of such space is determined as follows:

1. With no mechanical ventilation -

$$\text{Number of occupants} = \frac{\text{total volume in cubic feet}}{\text{500 cubic feet/occupant}}$$

2. With adequate ventilation -

$$\text{Number of occupants} = \frac{\text{area}}{\text{10 square feet/occupant}}$$

It can be readily seen from the foregoing that shelter capacity is not solely dependent upon the area of the available space but also upon two other factors; the total volume of the space and the adequacy of ventilation. Capacity is thus limited by volume in shelters that are either unventilated or poorly ventilated. Other factors being equal, the number of occupants in a shelter will vary in proportion at a ratio of 1:5 where there is natural ventilation as compared to forced ventilation. Thus, the capacity of an unventilated shelter 40' by 60' with a 10' ceiling could be increased from 48 occupants to 240 occupants by providing adequate ventilation.

In view of the random selection of shelters throughout the nation, it must be assumed that few will have an operating ventilation system, and that even less will be equipped to provide air conditioning.

Effective temperature control may be expected to present one of the most serious problems of shelter living. A careful review of existing studies has shown that the daily average maximum effective temperature in a shelter should not exceed 85 degrees Fahrenheit.

Among the unknown and unpredictable factors influencing shelter management planning is whether or not public utilities will continue to function. Overall planning on a national basis must consider the individual shelter as virtually autonomous and self-sufficient.

In conclusion, it should be stated that although survival, rather than comfort, is the objective of the shelter program, the psychological values of a carefully planned food program are essential to the individual's well-being and a vital influence on his post-shelter capabilities.

Aboard submarines, experience has shown that the crew's preoccupation with food and its preparation makes this the most important single factor in maintaining the morale of the crew. It is not unreasonable to expect shelter occupants will want to leave the shelter due to dissatisfaction with the food situation, even though it may be dangerous, as yet, outside. Careful planning and a sensible approach to the problem areas in the food program are important in the overall planning of shelter management.

Part A - ORGANIZATION AND MANAGEMENT OF FOOD SERVICES

I. The Nature of the Food Management Problem
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            (2) Hunger
            (3) Thirst
            (4) Odors
            (5) Illumination
            (6) Temperature and humidity
            (7) Sound or noise
            (8) Sleep
            (9) Appetite and taste
            (10) Crowding
            (11) Fears and tensions
    3. Post-exit Functions
        a. Protection from fallout
        b. Decontamination of water and food

A. ORGANIZATION AND MANAGEMENT OF FOOD SERVICES

In keeping with the primary purpose of the National Fallout Shelter Program, the first responsibility of management is to provide the best protection possible from fallout. Once this has been accomplished, the next obligation is to provide and manage an adequate supply of water and food to sustain life and maintain the health and strength of the occupants. This will enable them to restore the destruction caused by the emergency. In such an assignment, the most serious problem is not the procurement and distribution of food, so much as the control of the shelter occupants unused to the deprivations and restrictive living in this unusual situation. A study of the disasters of history as well as the experimental studies of simulated shelter living bears out the fact that pressures and critical decisions characterize the rationing and distribution of the water and food. In dealing with these problems, trained and determined leadership has often meant the difference between survival and failure. In poorly organized disaster situations, selfish individuals or cliques have sometimes achieved control and the results have been fatal.

I. The Nature of the Food Management Problem

Since this report deals with the procurement, stocking, preparing and distributing of water and food in large designated public shelters, special attention must be given to the organization and management of these functions. Under the overall authority of the shelter manager, the manager of foods will work out his divisional organization policies and procedures. His plans must take into consideration a variety of factors. Among these will be the habitability and size of the shelter;

the severity of the disaster; the kind of occupants he must serve; the nature and amounts of food and water stored; the qualifications of potential staff members; and the degree of overcrowding to be contended with.

Any of these factors can create serious administrative problems. The food supply may be inadequate for the number of people who have crowded into the shelter and no more can be procured because of the fallout. Crowded about him may be people of all ages and degrees of health who resist rationing and limited varieties of food. His efforts to do his work may be frustrated because of a poorly trained voluntary staff. The occupants will complain of poor ventilation, limited sanitary facilities, lack of privacy, poor sleeping conditions, and regimented activity. There may be concern about separated families, about the future outlook and the dangers of contamination.

Such potential problems place a heavy responsibility on Civil Defense for the selection and training of a suitable staff of officers. Careful consideration must be given to the responsibilities of the positions and to the leadership potential of the key men, as well as their orientation and training. It is hoped that the food manager will be selected well in advance of service and that he will be given pre-shelter training.

II. The Policies of the Food Manager

A predetermined list of policies based on disaster experiences and personnel administration principles could constitute ground rules

in the beginning for the new manager. Additional policies may be added as experience dictates, but a written platform in the initial phases of operation could be very useful. The following items are suggested:

1. With the goals of survival and recovery in mind, the food manager should provide firm management of his organization.
2. He should select the best candidates available for his staff.
3. He should offer as much training as time will allow, to prepare these people for the task ahead of them.
4. He should design and maintain an effective organization especially adapted to the size, occupants and special needs of this designated shelter. Provision should be made to organize the occupants into small manageable units for convenience in serving.
5. As department heads are appointed, the manager should delegate as much authority to them as is compatable with good discipline and tight control
6. To maintain effective cooperation and good morale, democratic procedures should be used in determining new policies and methods of control.
7. Where the administration of rations and sanitary practices require authoritarian methods, such power should be delegated to the manager by the occupants.
8. Once the shelter is closed, final authority for new decisions must reside with the occupants. The absence of guns and the impossibility of expulsion or isolation makes the use of

social pressure essential in maintaining order. American prisoners of war and other internees report a rapid breakdown of rank distinctions and the chain of command in such situations. A democratic approach usually follows.

9. In the selection and assignment of occupants for jobs, consideration should be given to maximum involvement of those capable of helping with the operations and activities. Participation will have important psychological values.
10. Food and water supplies should be kept under rigid control at all times even if force becomes necessary.
11. Regulations for the maintenance of sanitary practices should be set up and observed as far as food handling is concerned.
12. Strict impartiality in the rationing of water and food must be observed. Bartering in basic rations should be prohibited.
13. No ethnic or religious dietary practices followed in the preparation or serving of food can be recognized.
14. Daily inventories of remaining food should be made as a basis for determining rations.
15. The period of confinement should be used by the food manager to prepare the occupants for dealing with contaminated water and food.

The complexity and critical nature of the decisions in the platform of suggested principles and policies emphasize the need for careful training of the food manager. Before undertaking his assignment, he should be conversant with his equipment, supplies, the unusual nature

of his job, the problems of organization, and the behavior of humans under restraint and confinement. Consideration will be given to the training program after a discussion of the organization.

III. The Organization of the Food Services

The executive process is one of integration of the whole division through organization and control. Once the objectives and policies of the food manager have been completed, he must proceed with the development of an operating organization. The purpose of this organization is to achieve the goals of the shelter with effective procedures which provide for the cooperation and coordination which is by all members of the staff. Studies show that organization and leadership play an important role in developing shelter habitability. Coordination is the creative factor in this process, and it guarantees the best arrangement of operations and duties. A self-sustaining operation such as a public shelter which depends upon free service has special need for a well designed organization. Even though the size of the organization changes from shelter to shelter, it is an impersonal system which enables the manager to coordinate human effort.

A proposed chart for the overall organization of the shelter is presented in Exhibit A - 1. Such a chart as this should be drawn up by the managers of the larger shelters and posted for all staff members to see. The lines of the chart show that the manager of the shelter has been given authority for the administration of the unit. Because of the many basic decisions he may be called upon to make, he has

SHELTER ORGANIZATION CHART

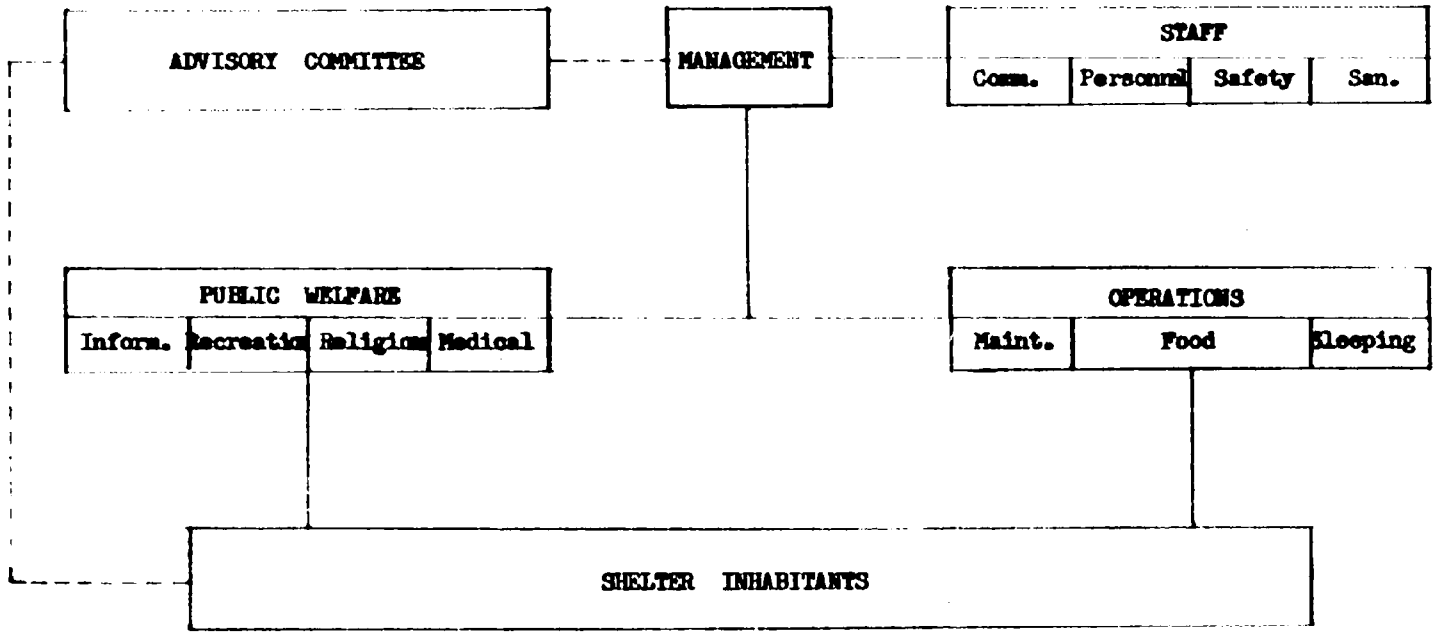


Exhibit A-1

been provided with an advisory committee of selected citizens from whom he can seek advice and support. This committee will have been selected from respected adults of the community. The chart indicates the functions of management of which food service is one. Each of these operations will be in charge of an assistant manager. When the size of the shelter justifies it, the food manager will further subdivide his unit into such functions as procurement, storage, preparation, cooking, service and sanitation. Once the organization is activated, final authority for the administration of the shelter should reside with the occupants. People usually submit to authority willingly when they believe it to be exercised well and responsibly in pursuit of approved goals. With a well-selected staff, the greater the delegation of power, the more efficient the operation of the organization is likely to be.

For convenience in feeding and other activities, the occupants of each shelter should be organized into manageable groups of from 8 to 10 people with a selected chairman to represent them. Several of these units may in turn be combined into sections and where the size justifies it, these sections could be combined into divisions for easier control.

Once the structure of the organization is completed with men or women selected to assume responsibility for each division, schedules for performance of routine activities should be arranged. The preparation and serving of food will need to take into consideration such things as the sleeping facilities and patterns as well as the equipment for serving food. When limited space makes it necessary, both feeding and sleeping may need to be operated in shifts, alternating in such a way as to serve all of the occupants at the appropriate time. Such a

condition would increase greatly the size of the food service force and the need for training.

Crowded passageways in the shelter will complicate internal traffic and feeding arrangements. Special areas of the shelter should be set up for feeding and special rules drawn up to assist with the management of traffic. Shelter experiments with children show that they tend to crowd around people preparing food and coffee. To avoid accidents or burns, a barrier should be placed around food operations where possible.

IV. Orientation and Training

For purposes of training in the problems of management and services of foods, the shelter situation divides itself into two periods of time - the pre-entry and the post-entry.

The pre-entry phase deals primarily with problems related to policies, purposes, organization, functions, supplies and equipment.

The post-entry phase considers assignment of space, selection and training of additional service personnel, the checking, storing and recording of additional food supplies, the preparing and serving of food under the restrictions of the shelter, the need for maintaining sanitary conditions, the importance of distributing water and food rations equitably, the need for cooperation to maintain reasonable morale, and the urgent problem of preparing both staff and occupants for the water and food hazards that might confront them when confinement is over.

The pre-entry training program would be under the general supervision of the local Civil Defense organization. In addition to selecting equipment and providing basic supplies, it is their important responsibility to select the shelter manager. He in turn would select such key assistants on his staff as the food manager, who would then select and train others for his manpower needs.

In the post-entry period, additional help must be selected, assigned and trained. Great care should be taken in identifying among the occupants the kinds of people who can be of greatest assistance with the food services. If a roster of the occupants has been made, and their previous experiences noted, this record should be used in identifying the kind of help needed. Special attention should be given to the selection of people who can deal effectively with other individuals even under trying circumstances. Problems dealing with knowledge of foods and processes of handling them, may be much less significant in the shelter management than problems dealing with the behavior of the persons under conditions of deprivation and frustration. People whose food, water and freedom have been restricted will present problems requiring special training to handle. Whatever methods may be used in preparing volunteers to help with the food service, emphasis should be on human behavior and human relations in such an exacting situation.

Unfortunately, no one will bring to the shelter experience with the kinds of situations that will confront them in a real shelter disaster. Fear, tension and even panic may need to be resolved by management. In addition to training his staff, the food manager has an obligation to inform the occupants of the shelter of the problems of probable food contamination after the confinement period.

V. Other Personnel Management Problems

1. Pre-entry Functions

a. The Selection of the Food Manager

As indicated above, the most important function of Civil Defense is the selection of the manager and his key assistants. Too much thought cannot be given to this responsibility. The success or failure of the shelter program depends to no small degree on management. There can be confusion and turmoil, or order and contentment, depending upon the leadership provided. If serious mistakes are made in choosing a manager, it will be too late to train someone else once the shelter is closed. The food manager should be selected with definite qualifications in mind. These qualifications include the ability to:

(1) Select, organize, train and manage an efficient team of voluntary assistants.

(2) Plan and direct food procurement, storage, preparation and distribution.

(3) Inventory available supplies and determine the most equitable and efficient way of serving them.

(4) Plan food and water rationing when necessary and manage its distribution with a minimum of disorder.

(5) Provide for cleaning and storing essential utensils and dishes under sanitary conditions.

(6) Know the nutrient and caloric values of available foods and how to balance them in a diet.

(7) Supervise his personnel in such a way as to insure efficiency of service, control and reasonable morale.

(8) Get along with and instruct a disturbed, dislocated and confused population trying to subsist under many restrictions.

If possible, his selection should be made from a list of qualified food managers in the community, but his ability to manage disaster problems may far outweigh the importance of food knowledge or skill. In a rationing situation serving of food is less complicated and the management of people uprooted and deprived of their usual needs, more difficult.

Since the onset of a disaster is unpredictable and may come when people selected and trained may be far away from their shelter, consideration should be given to selecting and training at least two people for each key post. Detailed instructions should also be posted in shelters for all vital operations in case no trained staff members arrive.

b. The Training of the Food Manager

In shelter experiments with management, the importance of pre-shelter training of the manager of foods has emerged. The well trained, influential leader played a significant role in the success of the program and in the acceptance of food. He in turn trained his staff in their

duties and responsibilities especially as they pertained to cooperative work with each other and good relations with the occupants. Each organization must arrange a sound training program based upon the fundamentals of learning and employ the best professional assistance the community affords for training. Where possible group discussion of actual cases should be undertaken and particular attention should be given to human responses under the severe deprivations and frustrations of historical disasters and confinement situations.

Practical problems that should be discussed early in the training program might include the following:

(1) A map of the community showing shelter facilities, size and the protection rating of each, as far as possible.

(2) The shelter organization and its relationship to the community Civil Defense Office of command.

(3) The functions and responsibilities of the food manager and his relationships to the manager.

(4) The policies pertaining to personnel administration, basic food operations, and occupants' welfare.

(5) Regulations governing food handlers sanitary and health practices.

(6) The relationship of good management to efficienty and acceptable morale in the shelter.

Special consideration should be given to the effects of the restrictions, frustrations and fears inherent in such a disaster program on the behavior of the occupants. Decisions involving life and death may have to be made. If so, they should be done with understanding, tact, sympathy, and courage. The people involved must be made to feel that decisions are made in the interest of the group as a whole. They must know that values beyond individual survival motivate the policies of the shelter. They must be made to understand the need for maximum cooperation of all people in the group if the goals of survival are to be achieved. Such cooperation has been achieved best in the past when the need for compliance is understood.

It has been observed in simulated studies of shelter management, that agitation and tension mount immediately after occupancy. Struggles for space are common. This is usually followed by depression. Fears are removed and dissensions quieted only through well trained leadership. Under crowded conditions, bumping, elbowing, complaining are sure to develop unless tolerance is created by wise management.

During the centuries that man has feared and survived disasters, the ability that one observes emerging most frequently is patience and cooperation. Whenever there is a serious fire, most men can be induced to cooperate in whatever efforts need to be made to subdue the conflagration, provided a good leader takes over.

The programming, disciplining and training for the rationing of water and food will create problems of administration for the manager for which he will have had no pertinent experience. The use of hot

foods, the distribution of the water and food and the reactions of the occupants must all be considered as unusual situations requiring organization and planning in advance. The fact that hot food increases its palatability and improves the morale of the occupants has to be weighed against the resultant heat problem in the shelter which may affect the comfort or even the lives of many people. The convenience of using biscuits or crackers as the basic food must be considered in the light of the fact that many children and some adults dislike these crackers and requiring them to eat only such food creates emotional problems. Compensating for their lack of palatability these basic cereal foods can be eaten out of hand, spread with jam or peanut butter, can be crumbled and served with milk and sugar as a breakfast food, or can be crumbled and served with soup, sauce, or gravy as a course for dinner or lunch.

The selection of food, its procurement and storage will have taken place before the shelter is occupied. If possible floor space too should be divided up and assigned in the interest of harmony and efficiency before occupancy.

c. The Assignment of Space

The earliest organization in a shelter usually involves the divisions of space. The struggle for preferred space in internment conditions has been one of the most controversial and difficult problems of management. The relative habitability or security of different spots in a large shelter will cause conflict and wrangling if assignment has not been made in advance. The food manager is particularly concerned

with selecting and designating feeding, storage and preparation space in advance and he must be on hand with his staff to maintain it as the shelter fills up. Preferred spots in the corners, against the walls, or under the stairways offering more security, some comfort and away from heavy traffic will be eagerly sought and defended. Even the ethics of "women and children first" cannot be depended on for all people in critical situations. Strong control at the very beginning making assignments according to plans, with group sanctions if possible, will save confusion and conflict later.

2. Post-entry Functions

When the shelters are open for occupancy, it can be assumed that the manager of food services has been selected and given as much training as needed. If the Civil Defense Organization of the local government has completed its responsibility, the shelter will have been made habitable, water and food supplies will be properly stored in one section of the shelter and equipment for its preparation and distribution will be available and ready for use.

In general, the food stocks procured will meet minimum dietary requirements to maintain health and energy. Unless basic rations have been supplemented, there should be enough to provide at least 715 calories of food and one quart of water per day for each occupant for a fourteen day period. The food should be reasonably palatable, contribute as little as possible to the waste disposal problem, require little or no cooking, and be easily prepared and served.

Potential occupants of the shelter will have been advised that they may, under some restrictions, supplement the basic ration with additional food. This additional food will not be allowed if storing it would in any way limit the number of people to be admitted to the shelter. Food brought to the shelter must be in conformity with the limitations used in setting up the basic ration and the additional food must be surrendered to the food manager for distribution.

Parents and guardians of infants will also have been notified that they may bring formulas or other appropriate food with them. Also persons with particular dietary needs such as diabetics will be allowed to bring special foods required by them to maintain health.

The food manager should have at least part of his staff with him as people are admitted to the shelter to receive, classify, and store these supplementary food supplies.

a. The Selection and Training of Service Helpers

As soon as the supplementary food has been taken care of, the food manager will be concerned with completing his organization. He may have to resort to temporary volunteers to assist with the food service the first meal or two while he investigates the qualifications of other occupants of the shelter. If all people entering were registered and some of their experiences recorded this material would help in his search for the best qualified help he can hope to find. No matter how he proceeds, qualifications suggested earlier for the selection of his staff should be applied to the additional assistants particularly where they will be working with the people in the shelter.

The number of new helpers required will depend on the number of people in the shelter to be served, the extent of overcrowding and the policy with respect to involvement of as many people as possible in activity of some sort. It is possible to have too many people involved with the food service, especially with crowded conditions. Because of the unusual conditions resulting from the disaster, and the nature of the confinement, all people selected to assist will need special instruction. They will need to be informed of the special needs for cooperation, patience and understanding in dealing with the people. The manager will explain his procedures and policies as he has developed them for dealing with his responsibilities. He will call their attention to the nature of the food to be served and the need for rigid controls in its distribution. He will present regulations and instructions for insuring sanitary food handling and urge compliance with them. The possibility and seriousness of sickness and abnormal behavior as a result of the confinement and fears should be explained, and finally the need for conserving water and food in case of prolonged need as a result of continued contamination outside will be stressed.

b. Sanitary Regulations for Food Handlers

As a part of the training program, regulations for the handling of food and garbage should be written out and posted. The following rules are suggested:

(1) No food exchange should take place in unsanitary surroundings.

(2) Anyone engaged in handling food must keep as clean as possible with the limited use of water in the shelter.

(3) Any abrasions, cuts or other exposed wounds should be covered.

(4) All service people should refrain from spitting or smoking while working with food.

(5) All articles or equipment used in connection with food operations must be kept as clean as possible as conditions permit, or be discarded if there is any risk of contamination.

(6) People with infectious diseases should not be allowed around the food.

(7) No food should be stored near toilets, or in poorly ventilated sections.

(8) If water is not available for washing hands, a pan with germicidal solution should be convenient to the toilet for use before handling food.

(9) Empty containers and waste food should be disposed of immediately in tight containers until they can be removed outside.

(10) Daily sanitary inspection should be under the supervision of either a medical officer or the food manager.

c. Behavior Problems Related to Deprivations

Confinement in a shelter with limited space, air, food and water will have many serious emotional and social effects particularly on children, women and those who are ill. The fact that there can be no release will not help the situation. Even in simulated studies where there was a panic button if anyone needed to be let out, there has been irritability, depression and many personality disturbances from these frustrations. These reactions together with fears, can only be removed or controlled through wise leadership, education and group organization. Communication with other shelters or the outside world will be very helpful if wisely used in reducing worries.

People working in the food services may be most likely to be in contact with occupants suffering from mental disturbances, and they should be able to identify them. The characteristics of people suffering from various deprivations are presented next.

d. The Nature of Deprivation Problems.

The administration of water and food in a shelter situation requires an imaginative grasp of the behavior of frustrated, frightened and restricted individuals. Few people have any real conception of what shelter living will entail. The many deprivations that must be imposed will cause physiological, psychological and social reactions that need to be understood to avoid confusion and loss of control. These reactions may result from confinement, reduced water and food supplies, foul air, high temperatures or humidity, loss of sleep, bad smells, unusual noises, crowding and uncertainty.

The major studies of human reaction to shelter conditions have been made with healthy male subjects and physiological effects rather than emotional and social reactions have been noted. With women and children in a real disaster where no escape is possible, many emotional and social problems will arise that the food manager and his staff must identify and deal with, when no doctors are available.

Physiological or sensory deprivations are the most serious and every effort should be made in planning shelter living to reduce them as much as possible. Where fresh air, adequate food, and sufficient water can be made available, life will be preserved and good morale may be developed. A shortage in any of these basic needs will start a chain reaction that will be difficult to control.

(1) Oxygen: This may cause temporary or permanent damage to the individual as well as severe problems of administration. Sufficient oxygen must be assured through a satisfactory ventilation system. If, by accident, the system should break down or overcrowding deplete the oxygen violent, uncontrollable activity such as that of a drowning person ensues ultimately, and paralysis is apt to occur. Undoubtedly, the person is unaware of the onset of his situation and may fail to realize the seriousness of the plight. Hence, supervisors must be on guard for any symptoms.

(2) Hunger: This may become an inescapable problem for many people in shelters if basic rations only are available. Some starvation is characterized by

by feelings of weakness, hunger pains, dizziness and blackouts upon standing up suddenly. The hunger drive becomes the dominant dynamic factor affecting the behavior of the person. There is constant preoccupation with thoughts of food. Ultimately the individual becomes unresponsive and uncooperative. Many emotional problems arise. Attempts are made to steal food and other signs of moral deterioration develop. The food manager is likely to have to deal with various degrees of hunger.

(3) Thirst: Man can live for weeks without food, but he can survive only a few days without water. Next to air, sufficient water should be given top priority in stocking supplies. Deprived of water for a long period of time, men report that sensations of thirst become maddening. Adequate water should be stored and protected against waste by the food service division. Serious behavior problems arise from a depletion of water in the human system.

(4) Odors: Bad odors in the shelter contribute to the discomforts of the situation and may be a real cause of complaint and turmoil. Fortunately, our olfactory senses become adapted to odors so that even foul odors become less objectionable, and very vew people are known to have died from bad smell. Nevertheless,

loss of appetite, nausea and aggression may result from bad odors, so that the food manager will struggle to reduce them as much as possible.

(5) Illumination: Sensory problems with light may result from over-stimulation or lack of it. Too much light has been known to cause increased tension among confined people and no light can create innumerable problems. Darkness will lower morale by reducing activities, reading, and training. Problems of illumination should be carefully planned and controlled if possible.

(6) Temperature and Humidity: It will be very difficult to control these factors in fallout shelters with uncertain sources of power and little access to fresh air. Hot, humid air sometimes produces vomiting and with little, if any water for sanitary purposes, it could result in a very messy as well as uncomfortable situation. Many of the internal temperature problems will arise in connection with attempts to provide hot foods so that the food manager may have to face controversial decisions in this case.

(7) Sounds or Noise: Here the problem may be excessive stimulation rather than deprivation, but judging from other confinement experiences, continuous or loud noises or even continuous harmony may irritate some people and cause aggressive emotional responses.

Every effort to mask or eliminate noises should be taken in the planning for shelter living. Noisy motors or fans may disturb some people. At least, control of unnecessary noise is a continuing problem for management.

(8) Sleep: The pattern of behavior by which we satisfy the need for sleep is partly the result of cultural factors. Our pattern is based on the regular alternation of light and darkness. Man may go many hours without sleep, although some sleep is necessary to recover from fatigue. Most people require from 6 to 9 hours of sleep daily, and when men have been allowed to sleep as much as they care to, the average was 7.9 hours per day. With sleep deprivation, concentration is impaired, motor performance deteriorates, and the individual is easily disturbed emotionally. Lack of sleep is a common complaint of people who have spent time in shelters. Many factors are involved, but every effort should be made to make sleep possible. Where lack of space makes it necessary to resort to shifts, the problems are multiplied.

(9) Appetite and Taste: Appetite may be stimulated by the sight, odor, and taste of food and with or without hunger. It can be stimulated by appetizers or destroyed by smells. Seeing others eat, stimulates eating. Habit plays an important part in the rhythms

of eating when situations are favorable. Taste will of necessity be sacrificed to convenience and survival. Some people may refuse to eat under shelter conditions and may insist on release before the signal for opening the doors is given.

(10) Crowding: Crowding involves most of the skin and muscle senses, but its real effect may be on the imagination. A feeling of claustrophobia is not uncommon in confined areas. The sufferer has a feeling that the walls are closing in on him and he is mentally very disturbed. By the very nature of the shelter, limitations in space will create problems of heat, odors, humidity, and aggressive behavior. Some people will insist on release in spite of any dangers that may be outside.

To these deprivations some of which may become tyrannical in nature, must be added the uncertainty of the future and the possible breakdown of outside protection. On the other hand, with wise management, shelter confinement could be nothing more than an unpleasant interruption of peoples' lives.

If at all possible under the circumstances, it is much wiser for management to avoid deprivations than have to deal with reactions from them. Wherever medical service is available, all indications of abnormal reactions should be referred to this department.

(11) Problems from Fears and Tensions. Anxiety, as well as the stresses or deprivations to be endured, is also productive of emotional disturbances. Fear of the unknown is a cause of emotional upset. In the early hours of shelter occupancy these symptoms may be quite common and may react unfavorably on the normal procedures of distribution and the morale of the occupants. The well trained manager will expect such problems and think first of involvement of these people in some activity to quiet them down.

To most Americans, the call to a disaster will be a novel and horrifying experience. The problem of leaving homes and pets and rushing to a community shelter without knowledge of the security of some member of the family will be a common and very distressing experience.

Less serious causes of emotional upset will be not knowing what to expect of shelter living; fear of contagious disease from the close contacts with people; fear of suffocation in such a small space; possible fear of radioactive contamination through contact with other people.

In the initial stages, some of these people will create serious management problems that will be reflected in rejection of food and increased aggression. Headaches and sleeplessness will follow with many of the occupants which they may attribute to food or noise. Both studies of actual disasters and polar studies have shown that the best way to deal with these initial disturbances is to find useful employment for these people if possible. Where space permits, some sort of activity could be organized or provided.

Small complaints about lack of privacy, no hot food, no reading facilities, etc. will come later and be an indication that the occupants are returning to normal and panic is over.

Given such developments as high temperature and high humidity, additional fears and discomforts will arise, particularly if methods of control are inadequate or absent. Even in submarines, where careful attention is given by engineers to prevention of such problems, they occasionally occur and cause both discomfort and illness.

Some occupants are sure to find the food unpalatable or at least monotonous and will refuse to eat it. The problem will become a nuisance but it may become severe if they try to leave the shelter before the signal for opening the doors is given.

Many will suffer from constipation on the diet now provided, with its lack of liquid, fruit, and other normal items.

Complaining occupants need to be reminded frequently that all men can endure much more than they think they can if they will do it, especially for the common good.

3. Post-Exit Functions

a. Protection from Fallout

Planning recovery from a real nuclear attack involves an imaginative effort at planning and reorganization. Destruction could be widespread with saturated contamination. The period of shelter occupancy should be used by the food manager to prepare for the water and food problems which they might face on leaving the shelter. If exploration or reports indicate that contamination is

widespread, the shelter organization could serve as a focus for cooperative community decontamination activities. This would be possible only if the occupants of the shelter together with the staff had prepared themselves during the confinement period for such an emergency.

Those in charge of training should be prepared to undertake the problem of familiarizing the population with the overall situation. They should inform them that systematic planning and informed management can insure survival if all who are able, continue to cooperate. If food in the homes, in restaurants, in stores, and in the fields have been contaminated, the food manager must plan to continue feeding operations until a safe food and water supply is assured.

Instruction in the process of identifying contaminated food and in the procedures for decontamination must be given as efforts at locating supplementary supplies are carried out. The period of shelter confinement should be thought of as a time for active preparation for post-shelter survival. Unless this is done, the entire national shelter effort may have been in vain. Classes should be organized to inform the occupants of the nature of the fallout problem and the methods essential to overcome it. If they are prepared in advance for such conditions, recovery will be speeded up and many lives may be saved.

b. <u>The Decontamination of Food and Water</u>

Since one of the objectives of civil defense actions is to minimize the radiation exposure of people to as low a level as

[illegible] the internal radiation hazard should be considered. Investigations have indicated that as a primary annihilator, ingestion of contaminated food and water is of little consequence. Radiation from ingested radioactive material produces gradual damage thus becoming a long-term postattack recovery problem.

If reports show contamination of homes and food, a decontamination team should be prepared to leave the shelter as soon as it is possible to locate and test food and water reserves. All radiological information available from any sources should be studied in anticipation of the problems to be faced by these scouts. They should develop proficiency in the use of radiological meters to provide information about the extent and rate of change in the fallout situation.

If communication with local Civil Defense headquarters has been maintained, their instructions with respect to the fallout situation and methods of dealing with it should be followed. Contaminated materials should not be burned, since ashes would only spread the contamination more widely. Radioactivity cannot be destroyed. It must have time to decompose.

If the food manager is forced to resort to food from the fields to meet his needs, he should know how to prepare fresh fruits and vegetables as well as field crops or meat animals for safe consumption. Sometimes a washing or peeling is adequate to remove fallout danger from fruits and vegetables. People in the shelters who had followed instructions to stockpile a supply of selected foods in proper containers in anticipation of such a contingency might now be in a position to contribute to the welfare of the community.

It should be kept in mind that in any phase of a disaster program water is more vital than food and should be given first consideration. Domestic water supplies from underground sources will usually remain free from radioactive contamination, but water from open reservoirs is likely to need purification. If so, it should be remembered that such usual methods as boiling and chlorination have no value as far as decontamination is concerned. Such treatment as coagulation, sedimentation, and filtration have been found to be effective in removing fallout. Water may be distilled to make it safe for drinking purposes. The water contained in a hot water heater at home might serve as an emergency supply if it can be removed without admitting contaminated water. Radiation itself does not affect water. Water simply carries it.

The countermeasures for contaminated food and drinking water have been developed and evaluated. They include conventional food processing techniques and existing conventional water treatment procedures, plus suggested expedient measures. These involve no new principle or phenomena in addition to those already considered in the public health, sanitation and water supply field. The major portion of the fallout will be insoluble and removed along with the sand, silt and other surface contaminants. In no case should food or water be wasted or thrown away. As a general rule, the best quality of water and the least contaminated food should be consumed first. However, no one should be denied food or water if the only source available is contaminated. Infants and small children should be fed a milk substitute like similac, saylac or a product like metrecal.

Summary

An analysis of the problems of management expected to characterize the supervision of large public shelters, reveals many new kinds of situations in connection with water and food administration. The control of the shelter occupants under the restrictive living caused by efforts to shield themselves from fallout while avoiding excessive expenditures for shelters creates new experiences.

From the selection of the food manager to the final dismissal of the occupants from the shelter, every phase of living will be novel to the average American, and the water and food management can be unusual and critical. If success is to be gained, much will depend upon the policies of the manager, the organization of the food service, the orientation and training of the voluntary help, the cooperation of the occupants and the instructions provided for dealing with contamination and destruction in the post-shelter period.

This indicates the need for an early selection of key employees and a well-formulated and imaginative training program to achieve the kind of operation that will guarantee maximum survival.

Part B - FOODS AND FEEDING

I. CHARACTERISTICS OF WATER AND FOOD SUPPLIES

1. Specification of Water and Foods

2. The Composition of Foods

3. Characteristics of Water and Food Containers

a. Water

(1) Federal Stocking - 17-1/2 gal.

(a) Description

(b) Precautions

(c) Filling the containers

(2) Plastic Containers - 5 gallon

(3) Metal Containers - 5 gallon

(4) Metal Containers - 8-10 ounces

(5) Water in pipes and tanks

b. Food

(1) Varieties of cereal rations

(a) Survival crackers

(b) Survival biscuits

(c) Bulgar wafers

(2) Pure carbohydrates

(3) Canned foods

(4) Other foods

SUMMARY

I. CHARACTERISTICS OF WATER AND FOOD SUPPLIES

To aid the manager in his planning, it is desirable to know something about the form in which food will be available to him.

Prior to occupancy, the shelter will be stocked in one of several ways:

Federal stocking - consisting of 14 quarts of water and 10,000 calories in the form of biscuits and possibly hard candies.

Partial Supplement - consisting of the addition of spreads to the above stocking, bringing the total calorie count up to 18,000 calories.

Near Normal Stocking - adding canned fruits, soups, meats and so on, bringing the total calorie content to any desired level.

In the event of supplementary stocking, the water supply should be increased to 28 quarts per occupant, particularly if protein is added to the diet.

1. SPECIFICATIONS: Foods should conform to the following:

   a. A relatively long shelf life. Generally, the selection of foods having a longer shelf life reduces the problems of surveillance and replacement.

   b. Palatability. So that the food selected be acceptable to most of the shelter occupants, it is desirable to stockpile food of the kind usually consumed in the area. Exotic, highly seasoned, or foods possessing "extreme" flavors are to be avoided.

c. May be eaten hot or cold. Circumstances may preclude the service of hot foods, therefore it is deemed highly advisable that foods selected may be eaten at room temperature.

d. Relatively economical. Price is always a factor where large stockpiling is necessary.

e. Easily prepared and served. Simplicity of preparation and service of food under mass-feeding conditions would contribute to the overall efficiency of the food program. If possible, the only utensil used should be a spoon.

f. Suitability. Foods selected should be suitable to the clientele of the shelter. For example, prepared menus for a school shelter would differ from those prepared for an industrial plant.

g. No waste characteristics. Garbage disposal will be a problem so it is recommended that foods will be completely edible.

h. Variety in texture and consistency. A reasonable amount of roughage should be included in the concentrated-type diet.

i. Containers should be vermin-proof.

j. High caloric/bulk ratio. Except for water, foods should have a high caloric content where space is limited.

k. Hygroscopic qualities. Foods that absorb moisture, used in an area of anticipated high humidity should be avoided.

l. Minimum food spoilage.

m. k values such as to reduce cooling time (shorter cooking time).

n. High liquid if cooked in container.

o. Freeze-proof.

p. Resistance to high humidity. For example, bulk-packed cereals in the usual paper containers would soon break down.

q. In cans - dimensions (Size 3 or less) no greater than 4-1/14" in diameter, or 7" high, if heating is contemplated.

r. Spread or served in cups.

s. Eat out of cup with spoon.

2. THE COMPOSITION OF FOODS

All essential dietary elements have been provided for in the basic food stocked by Civil Defense. As long as the major portion of the food supply is made up from these biscuits, the food manager will not need to be concerned about nutritional balance of the diet. If however, supplementary foods constitute a major portion of the food used, some attention should be given to supplying essential elements in the meals. The accompanying charts consisting of foods likely to be selected for shelters are taken from the U. S. Department of Agriculture Handbook No. 8. They show the caloric and other values of various types of foods in terms of common household units. Such tables should be helpful in selecting and preparing foods for the occupants.

COMPOSITION OF FOODS FOR SHELTERS IN

COMMON HOUSEHOLD UNITS

Catalog Number	FOOD DESCRIPTION AND MEASURE (Approximate)		Food Energy (Calories)	Protein	Fat	Total Carbo-hydrates
		JUICES				
10	Apple Juice Fresh or Canned	* 1/2 cup	62	.10	.0	17.2
329	Grape Fruit Juice Sweetened	1/2 cup	65	.60	.20	17.2
332	Grape Fruit Canned Sweetened	1/2 cup	65	.60	.20	17.4
336	Grape Fruit bottled Commercial	1/2 cup	85	.50	.0	23.1
445	Orange Juice Canned Unsweetened	1/2 cup	54	1.00	.30	13.60
508	Pineapple Juice Canned	1/2 cup	60.5	.30	.10	16.2
548	Prune Juice Canned	1/2 cup	85	.50	.0	23.2
686	Tomato Juice Canned	1/2 cup	25	1.20	.30	5.20
682	Tangerine Juice, Unsweetened	1/2 cup	47	1.10	.40	11.3
		BEVERAGES				
234	Cocoa Beverage Made with milk	1/2 cup	118	.40	.60	13
406	Evaporated milk unsweetened	1/2 cup	173	8.80	9.90	12.9

* 1/2 cup equals 4 ounces

EXHIBIT B-1

COMPOSITION OF FOODS FOR SHELTERS IN
COMMON HOUSEHOLD UNITS

Catalog Number	FOOD DESCRIPTION AND MEASURE (Approximate)		Food Energy (Calories)	Protein	Fat	Total Carbo-hydrates
	FRUITS AND VEGETABLES					
11	Applesauce canned unsweetened	1/2 cup	50	.25	.25	13.2
12	Applesauce Canned sweetened	1/2 cup	92	.25	.2	25.
15	Apricots canned waterpack	1/2 cup	38	.60	.10	9.90
16	Apricots canned syrup pack	1/2 cup	102	.75	.20	27.4
38	Red Kidney Beans canned	1/2 cup	115	7.30	.50	21.
40	Red Kidney Beans Canned baked Pork and Molasses	1/2 cup	162	7.50	4.3	25.
41	Pork and Tomato Sauce	1/2 cup	147	7.50	2.7	24.
42	Beans, Lima canned	1/2 cup	88	5.0	.4	16.8
91	Beets, Canned	1/2 cup	41	1.10	.10	9.7
107	Blueberries canned water pack	1/2 cup	45	.50	.50	11.0
108	Blueberries canned syrup pack	1/2 cup	122	.50	.50	32.4
225	Chili Con Carne Canned no beans	1/2 cup	85	4.4	6.3	2.5
247	Corn Canned	1/2 cup	85	2.6	.65	20.60
275	Biscuits (Nat'l. Bisc. Co.) 1 biscuit		30	8.4	8.4	79.0
318	Fruit Cocktail canned	1/2 cup	88	.50	.25	23.8
326	Grape Fruit Canned in syrup	1/2 cup	90	.45	.25	23.8
406	Pineapple Canned Syrup	1/2 cup	102	.60	.150	27.5
463	Peaches sliced canned	1/2 cup	38	.40	.10	10.1
474	Pears Canned water pack	1/2 cup	38	.35	.10	9.9
475	Pears Canned Syrup pack	1/2 cup	84	4.2	.50	16.05
479	Peas, green canned	1/2 cup	84	4.2	.50	16.05

COMPOSITION OF FOODS FOR SHELTERS IN

COMMON HOUSEHOLD UNITS

Catalog Number	FOOD DESCRIPTION AND MEASURE (Approximate)		Food Energy (Calories)	Protein	Fat	Total Carbo-hydrates
		JAMS AND JELLIES				
350	Honey Strained or Extracted	1 tbls.	62	.10	.0	16.40
353	Jams, Marmalades, Preserves	1 tbls	55	.10	.10	14.20
354	Jellies	1 tbls	50	.0	.0	13.50
415	Molasses Cane Light	1 tbls	50	.0	.0	13.50
472	Peanut Butter	1 tbls	92	4.2	7.6	3.4
665	Sugars Granulated	1 tsp	16	.0	.0	4.2
		CANDY				
177	Butterscotch	1 oz.	116	.0	2.5	24.3
178	Caramels	1 oz.	118	.8	3.3	22.
179	Chocolate Sweetened Milk	1 oz.	143	2.	9.5	15.8
180	Chocolate Sweetened Milk - Almonds	1 oz.	151	2.3	10.9	14.2
181	Chocolate Creams	1 oz.	110	1.1	4.0	20.
184	Hard	1 oz.	108	.0	.0	28.
186	Peanut Brittle	1 oz.	125	2.4	4.4	20.6

Exhibit B-1

COMPOSITION OF FOODS FOR SHELTERS IN
COMMON HOUSEHOLD UNITS

Catalog Number	FOOD DESCRIPTION AND MEASURE (Approximate)		Food Energy (Calories)	Protein	Fat	Total Carbo-hydrates
	SOLIDS (MEATS & FISH)					
79	Corned Beef Hash Canned	3 oz.	120	11. 7	5. 2	6. 1
80	Roast Beef Canned	3 oz.	189	21.	11.	0
83	Corned Beef, Canned Lean	3 oz.	159	22. 5	7.	0
84	Corned Beef, Canned, Med. Fat	3 oz.	182	21. 5	10.	0
85	Corned Beef Canned, Fat	3 oz.	221	20.	15.	0
86	Beef Dried or Chipped	1/2 cup	168	28. 3	5. 2	0
525	Canned Ham, Spiced	2 oz.	164	8. 4	13. 8	. 9
	Luncheon Meat - Canned Spiced Sausage, Pork	2 oz.	164	8. 4	13. 8	. 9
591	Salmon, Sockeye (Red) Canned	3 oz.	147	17. 2	8. 2	0
592	Sardines, Canned Oil	3 oz.	288	17. 9	23.	. 9
692	Tunafish, Canned	3 oz.	247	20. 2	17. 8	. 0
	SOUPS					
612	Bean, Condensed	4 oz.	160	7	4	24. 8
614	Beef, Condensed	4 oz.	83	5. 0	2. 8	9. 2
621	Clam Chowder, Condensed	4 oz.	70	3. 6	2.	10.
628	Pea, Condensed	4 oz.	119	6.	1. 6	21. 2
630	Tomato, Condensed	4 oz.	70	1. 6	1. 6	15.
632	Vegetable, Condensed	4 oz.	67	3. 4	1. 4	12. 9
636	Navy Bean (Dehydrated)	1 oz.	92	5. 0	. 3	17. 8

Exhibit B-1

3. CHARACTERISTICS OF WATER AND FOOD CONTAINERS.

a. Water. Water is available in a number of containers.

(1) Federal Stocking. The description and instructions for operating Federal water storage containers are shown in detail below. These instructions are provided to insure that potable water stored in public fallout shelters will be safe for use in emergency. The importance of sanitary procedures must be emphasized throughout all operations.

(a) Description. Components of the Civil Defense Water-Storage Container are a metal drum, with removable lid, 16 inches in diameter and 21 inches high; and a double plastic (polyethylene) bag liner, of 4-mil thickness, with the inner bag having a spout formed at one end. Included with the plastic bags are plastic wire ties for tying off the spout and outer bag. See Exhibit B - 2.

The drum, with plastic bag liner, has a capacity of 17-1/2 gallons and, when filled, weighs about 150 pounds.

The drums are shipped individually (minimum of 10) to approved recipients, and the bag liners will be packed 20 sets to a case. In some instances, bag liners may be unpacked at central receiving points and then sent on to various locations in one or more drums.

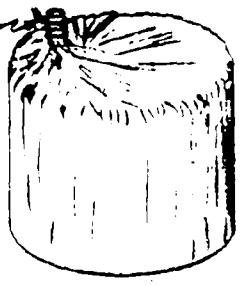
(b) Precautions

(1) Water used to fill the containers must be from a source approved by the State or local Health Department.

CIVIL DEFENSE
WATER STORAGE UNIT
17½ GAL. CAPACITY

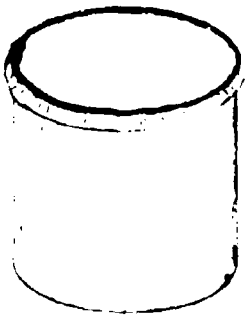
DRUM COVER

SPOUT SEALED WITH PLASTIC WIRE

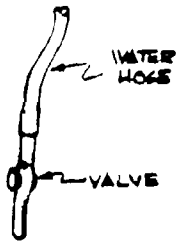


PLASTIC INNER LINER WATER BAG

DISPENSER FROM SANITATION KIT



PLASTIC OUTER LINER BAG



FILLING APPARATUS

RIGID DRUM

EXHIBIT B-2

(2) Sanitary conditions must be maintained at all times in filling the containers. Supervisors must be well aware of the dangers of contamination. All those who work with the containers must maintain good personal hygiene.

The Civil Defense Water-Storage Container is intended primarily for storage, and is not designed for shipping water. The containers - particularly the plastic bags - can be damaged easily if shipped full of water.

(a) The overall filling procedure for the community must be under the care of a State or local health department engineer or sanitarian.

(b) No one who has, or is suspected of having, a communicable disease, or has an open or infected sore, should be allowed to work with the water containers.

(c) Equipment must be kept clean at all times.

(d) Workers must be particularly careful to have clean hands at the beginning of and during the filling operations.

(e) Contamination of all kinds must be kept away from the water.

(f) When a container is filled, the spout must be closed rightly so that the water can be stored for an indefinite period without danger of contamination.

(g) The containers should be filled at or near, (within the local area), the shelter where they are to be stored.

(h) There may be some advantage in filling containers at a central location and then moving them to various shelters in the local area. For example, it may be

easier to control sanitary conditions. If the containers are filled at one location and moved to another, they should be moved very carefully.

(i) The plastic bag liners must be handled carefully to avoid abrasions or punctures -- so there will be no leakage in storage. Do not sharp-crease or double-fold the bags.

(c) Filling the containers. Note: a short length water tube or hose (ordinary garden-hose size), without nozzle, is used for filling the water containers. The tube or hose must be kept clean.

In the event a longer hose must be used, the end of the hose should be fitted with a circular guard made of heavy metal and a shut-off valve should be provided within reach of the person filling the containers.

1. How to start

(a) Remove the drum cover. Make sure the inside of the drum is free of foreign matter. Place the liner bag set in the drum, making sure the bag set bottom is against the bottom of the drum. Drape the outer bag down and around the top of the drum. Let spout of inner bag drape over the top of the drum.

(b) Flush the hose for 5 minutes before filling the containers.

(c) Insert end of a clean water tube or hose, without nozzle, into the bag spout and start filling with water to a depth of abour 4 inches. Be careful not to spill water on the drum or into the space between the drum and liner.

(d) When there is about 4 inches of water in the bag, stop filling.

(e) Add 1 teaspoonful of household liquid bleach (active ingredients 5. 25% sodium hypochlorite; 94. 75% inert ingredients). Liquid bleach of this type is found in supermarkets and other stores.

2. Reseat the bag liner. The bottom of the plastic bag liner should now be reseated.

(a) Remove the water tube or hose from the spout.

(b) Grasp the bag liner firmly at the sides (do not lift by spout), and lift far enough for proper reseating. The bottom seam of the liner should extend along the diameter -- across the center -- of the inside base of the drum. Correct positioning will avoid uneven strain on the bag liner when full.

3. Continue filling

(a) Re-insert clean water tube or hose in spout -- and continue filling the bag with water.

(b) Fill to the water-fill makr on outside of the drum. This mark is about 1 inch from the top of the drum.

(c) Remove water tube or hose from the spout.

(d) Exhaust air from the bag liner by pressing the top of the inner bag down to water surface.

(e) Twist spout, double it back and tie securely with plastic wire provided.

Caution: Do not tie the plastic wire so tightly the spout will be damaged.

(f) Gather the top of the outer bag together and tie off with a wire tie. Replace drum cover.

Note: See Exhibit for graphic description.

(2) Plastic containers. 5 gallon plastic bags - Such containers are comparable to the 17-1/2 gallon containers. They are available from dairy supply houses, and offer the attraction of being low in price and lighter.

(3) Metal containers - 5 gallon - These containers are a standard 5 gallon metal can with locked down top, with a plastic "bottle" for water. The pouring spout is depressed and covered with a metal cap seal. Bottles are filled with distilled water and are sealed at the bottling plant. The assembly weight is approximately 22 pounds, and presents no problem in transportation, pouring or emptying into a water heater. The container will stack, and may be stacked four or five high.

In storing these containers, a light covering sheet of plastic film should be placed over the top of each which can be removed before

use, serving as a dust cover to prevent contamination while pouring.

To use, the light metal cover is removed, the neck of the bottle is pulled out, and the seal on the cap destroyed.

After emptying, the metal cover can be removed with a standard beer can opener, the top of the flank can be cut off and the resulting container be used for refuse or sanitary needs.

(4) Metal containers - 8-12 ounces - 10-1/2 ounce cans - 207 x 411. These containers are easily handled and issued in units. Three cans constitute a daily ration, falling 1/2 ounce short of a quart. Their size is highly convenient for three times a day issue. They are opened with the conventional beer can opener. Empties can readily be replaced in original containers.

(5) Water in tanks and pipes. In most buildings, there is a considerable amount of water available in the pipes, hot water tanks, and even in the boilers which could be used in an emergency. It is necessary to provide valves or faucets permitting isolation draw off and venting, so that the water may be readily obtained. Portable containers should be available for this purpose.

It should be borne in mind that toilets will not be operative if the community water supply fails. There is a rather delicate balance between the volumes of water and ingested food retained

by the body and the resulting waste. Approximately 70% of the total volume consumed will appear as waste. Provision for this is made where water containers may be used as waste disposal containers. It follows, therefore, that if water is drawn from the building supply, provision must be made for additional waste containers.

Such provision might be waterproof plastic bags of adequate strength which would act as liners in pails. When full, the bag would be tied at the neck and removed from the shelter for subsequent disposal, and the pail retained as a recipient for the next bag.

To provide mechanical seating, a bench can be made with cutouts under which the pails would be stored. Five gallon pails, similar to paint or nail containers, would be excellent for this purpose.

b. Food

1. Varieties of biscuits

Survival biscuits packed in tins have a long shelf-life, high caloric value, and are suitable for out-of-hand eating. They are solid enough to allow the addition of spreads such as jam, peanut butter or cheese.

Biscuits are supplied by a number of companies. The characteristics of packs by several companies appear in Exhibit B-3.

2. Carbohydrates in the form of hard candy

Mixed hard candies, either lemon or wild cherry flavored, may constitute up to one-third of the Federal Ration. These will be packed loosely in 5 gallon square metal cans weighing approximately 32 pounds. Inside the cans will be 20 coated paper bags. The can size is 9-3/8" x 9-3/8" x 13-7/8". It is made of tin plate. The cans may be either soldered closed or provided with a screw top. Cans will be packed two per case in a fiberboard box whose dimensions will be approximately 9-3/8" x 18-3/4" x 13-7/8".

3. Canned foods

Canned food which is to be heated should be in cans smaller in diameter than 4-1/6". The contents of cans of various size is of importance as well as the determination of can sizes. As an aid to this end, see "Cans per 100 Portions for Homogeneous Products". These tables were designed to permit easy determination of can size and contents by anyone.

Exhibits 5 and 6

EXHIBIT B-3. PHYSICAL CHARACTERISTICS OF BISCUITS

. COMPANY I - Survival Biscuit. (Sealed Hermetically)

Pack	Case	Tin	Package	Count	Calories
	1	6	90	2320	70,200
		1	15	390	11,700
			1	26	780
		0.256		100	3,000
Dimensions (inches)					
Longest	26.5	13.0			
Middle	14.0	8.5			
Shortest	12.0	5.5			
Weight - pounds					
Gross	40.0				
Net	34.5	5.75			
Capable of stacking	Yes	Yes			

Recommended Opener for tins	Class I	Class II	Class III	Class IV	Class V
	Yes	Yes	No	No	No

COMPANY II - Survival Biscuit. (Sealed Hermetically)

Pack	Case	Tin	Package	Count	Calories
	1	?	?	?	?
		1	?	1091	32,730
			1	?	?
				1	30
		.0915		100	3,000
Dimensions (inches)					
Longest		14.0			
Middle		9.5			
Shortest		9.5			
Weight - pounds					
Gross		?			
Net		12.25			
Capable of stacking	Yes	Yes			

Recommended opener for tins	Class I	Class II	Class III	Class IV	Class V
	•Yes	Yes	No	No	No

(Continued)

EXHIBIT B-3 Continued

PHYSICAL CHARACTERISTICS OF BISCUITS

COMPANY III - Survival Biscuit. (Sealed Hermetically)

Pack	Case	Tin	Package	Count	Calories
	1	6	180	2790	83,700
		1	30	465	13,950
			1	15	450
				1	30
			.215	100	3,000
Dimensions (inches)					
Longest	26	13			
Middle	13.5	8.5			
Shortest	11.75	5.5			
Weight - lbs.					
Gross		8.0			
Net		7.0			
Capable of stacking	**Yes**	**Yes**			

Recommended opener for tins	Class I	Class II	Class III	Class IV	Class V
	Yes	Yes	No	No	No

Can Openers - Class I "Butterfly" Class II "Survival Kit"

4. Other Foods - Units per 100 portions

Sugar - 1 tsp. = .010 lbs. /100 portions

Coffee -(Dehydrated) - 1 tsp. = 0.070 gr. oz. = 14.3 servings/ gr. oz. = 7 gr. oz. /100 portions

Crackers

Jam and Marmalade - 1.408 gr. oz. = fl. oz.

Peanut butter

Summary

The work of the food manager will definitely be influenced by the form of the food available to him. In the case of the water supply, the size and nature of the containers as well as the total amount will affect the rationing procedures. Whether the food is palatable, whether it can be eaten cold, whether it is conveniently packed for serving, whether it has been balanced for food values and many other characteristics will determine the amount of service required to prepare it for distribution.

Whatever the nature of the food or the processing involved, strict sanitary regulations for food handlers and equipment must be observed. The difficulty of this precaution will be increased with the restriction on the use of water for purposes other than drinking. The use of both canned food and canned water as recommended will greatly reduce the amount of work involved in serving meals, and at the same time improve the opportunity for managing definite portions for each individual.

II. MENU PLANNING AND STOCKING

1. Prior Entry

   a. Examples of Menus

      (1) Babies

      (2) Adults

   b. Market orders

      (1) Explosion of menu

      (2) Market order development

2. Entry

   a. Recommended individual food packs

   b. Reception at entry

      (1) Mechanics of reception

      (2) Non-perishable items

      (3) Perishable items

II. MENU PLANNING AND STOCKING.

1. Prior Entry

a. Examples of Menus - Menus can be made up at the discretion of management, in terms of the desired expenses and the likes of the occupants. Food management in the shelter will of necessity have limited variation in its menus. Where a high percentage of the food available has been provided as supplementary to the basic diet, the menu problem will be to attain a degree of caloric balance. Other concern will be to provide as much variety as possible and improve the taste of the biscuits with spreads.

(1) Baby Foods - One very important item is provision for infants' feeding, in the event such a type of occupant is expected. Evaporated milk, in the order of one can per occupant (baby) per day should be stored. Pediatricians indicate that babies may be fed on room temperature milk without bad effect; in the event that no facilities exist for warming bottles. Bottle sterilization with hot water may be difficult, but provision should be made for sterilizing with chemical solutions, such as sodium hypochlorite or benzalkonium chloride. Additional baby foods should not be stocked.

(2) Adults - Examples of Menus - To serve as a case in point, the following menus are suggested for near normal diets. Note that provision for heating foods has been made. Note further that total daily calories have been estimated, using the tables of caloric value following the menus.

Exhibit B - 4

Seven Day Menu, based on 30 Calorie Survival Crackers, plus Variety Supplement - 1200 Calorie Value.

FIRST DAY	Caloric Value	
Breakfast:		
4 oz. Fruit Juice	46	
3 Crackers	90	
1 oz. Jam	110	
8 oz. Coffee	0	
1 tsp. Sugar	16	
1/2 oz. Evap. Milk	22	284
Lunch		
7 Crackers	210	
1 oz. Peanut Butter	180	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	428
Dinner		
9 Crackers	270	
2 oz. Deviled Ham	165	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	473
TOTAL		1185

SECOND DAY		
Breakfast:		
4 oz. Tomato Juice	23	
4 Crackers	120	
1 oz. Marmalade	110	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	291
Lunch:		
5 Crackers	150	
6 oz. Pork & Beans	243	
8 oz. Coffee	0	
1 tsp. Sugar	16	
1/2 oz. Evap. Milk	22	431
Dinner:		
6 Crackers	180	
8 oz. Vegetable Soup	75	
8 oz. Ovaltine	239	494
TOTAL		1216

Exhibit B - 4 (Continued)

THIRD DAY	Caloric Value	
Breakfast:		
6 Crackers	180	
4 oz. Fruit Juice	46	
1 oz. Jam	110	
8 oz. Coffee	0	
1 tsp. Sugar	16	
1/2 oz. Evap. Milk	22	374
Lunch:		
5 Crackers	150	
8 oz. Tomato Soup	90	
1 oz. Jam	110	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	388
Dinner:		
7 Crackers	210	
2 oz. Tuna Fish	165	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	413
	TOTAL	1175
FOURTH DAY		
Breakfast:		
7 Crackers	210	
4 oz. Fruit Juice	46	
1 oz. Jam	110	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	404
Lunch:		
5 Crackers	150	
3 oz. Canned Corn Beef	182	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	370
Dinner:		
5 Crackers	150	
8 oz. Asparagus Soup	210	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	398
	TOTAL	1172

Exhibit B - 4 (Continued)

FIFTH DAY	Caloric Value	
Breakfast:		
7 Crackers	210	
4 oz. Tomato Juice	23	
1 oz. Jam	110	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	381
Lunch:		
7 Crackers	210	
2 oz. Beef Stew	150	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	398
Dinner:		
1 Cracker	30	
8 oz. Cream of Mushroom Soup	180	
8 oz. Ovaltine	239	449
	TOTAL	1228

SIXTH DAY		
Breakfast:		
6 Crackers	180	
4 oz. Fruit Juice	46	
1 oz. Jam	110	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	374
Lunch:		
4 Crackers	120	
6 oz. Spaghetti & Tomato Sauce	239	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	397
Dinner:		
8 Crackers	240	
2 oz. Vienna Sausage	140	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	418
	TOTAL	1189

Exhibit B - 4 (Continued)

SEVENTH DAY	Caloric Value	
Breakfast:		
4 oz. Fruit Juice	46	
7 Crackers	210	
1 oz. Jam	110	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	404
Lunch:		
6 Crackers	180	
1 oz. Peanut Butter	182	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	400
Dinner:		
8 Crackers	240	
8 oz. Barley Soup	100	
8 oz. Coffee	0	
1 tsp. sugar	16	
1/2 oz. Evap. Milk	22	378
	TOTAL	1182

It does not follow that these meal plans must be followed. Each shelter management will pursue its own policy.

b. Market Order

(1) Explosion of menu. - With the menu planned, first explode it into portion counts as shown under "Examples of Menus - 1 week", Exhibit B - 4. Since it is proposed to repeat this menu for two weeks, it will be necessary to multiply the portions by two. As an aid to this end, see Exhibit B - 5, "Cans per 100 Portions for Homogeneous Products". These sets of tables are designed to permit easy identification of can sizes and contents by anyone.

(2) Market Order Development.

Then compile an order list, showing total units for each item, see "Order List". Thus, fruit juices require from the Menu Explosion 4000 fluid ounces. Determine from your local markets the size of cans to be used. Remember, if heating is anticipated, no can containing more than 26 fluid ounces should be used if it is subject to being heated.

It appears from market shopping, that fruit juices are obtainable in a can 4-1/4" in diameter by 7" high. Examination of the table, "Cans Per 100 Portions" shows that such a can delivers 46 fluid ounces and that 2.18 cans are required for 100 ounces.

Multiply the 4000 fluid ounces required from the menu explosion times 2.18/100, arriving at a product of 87.2 cans. Cans of this size are packed 12 to a case. Dividing 87.2 by 12 determines that 7.27 cases are needed. Round off to the nearest whole number at 7.

Proceed in a similar manner throughout the list. Additional conversion tables are required. These appear under "Additional Conversions". Furthermore, the physical properties of crackers

appear in Exhibit B-3.

Another order list for food has now been created. See "Order List".

For convenience, "Conversion Tables of Equivalents" appears in the Appendix.

2. Entry

a. Recommended individual food packs.

The National Plan for Civil Defense calls on everyone to have a minimum 14-day supply of water and food on hand for emergency use.

These supplies could be stored at home, in the trunk of the family car, or at work. They should be of a nature allowing for use and replacement perhaps once or twice a year.

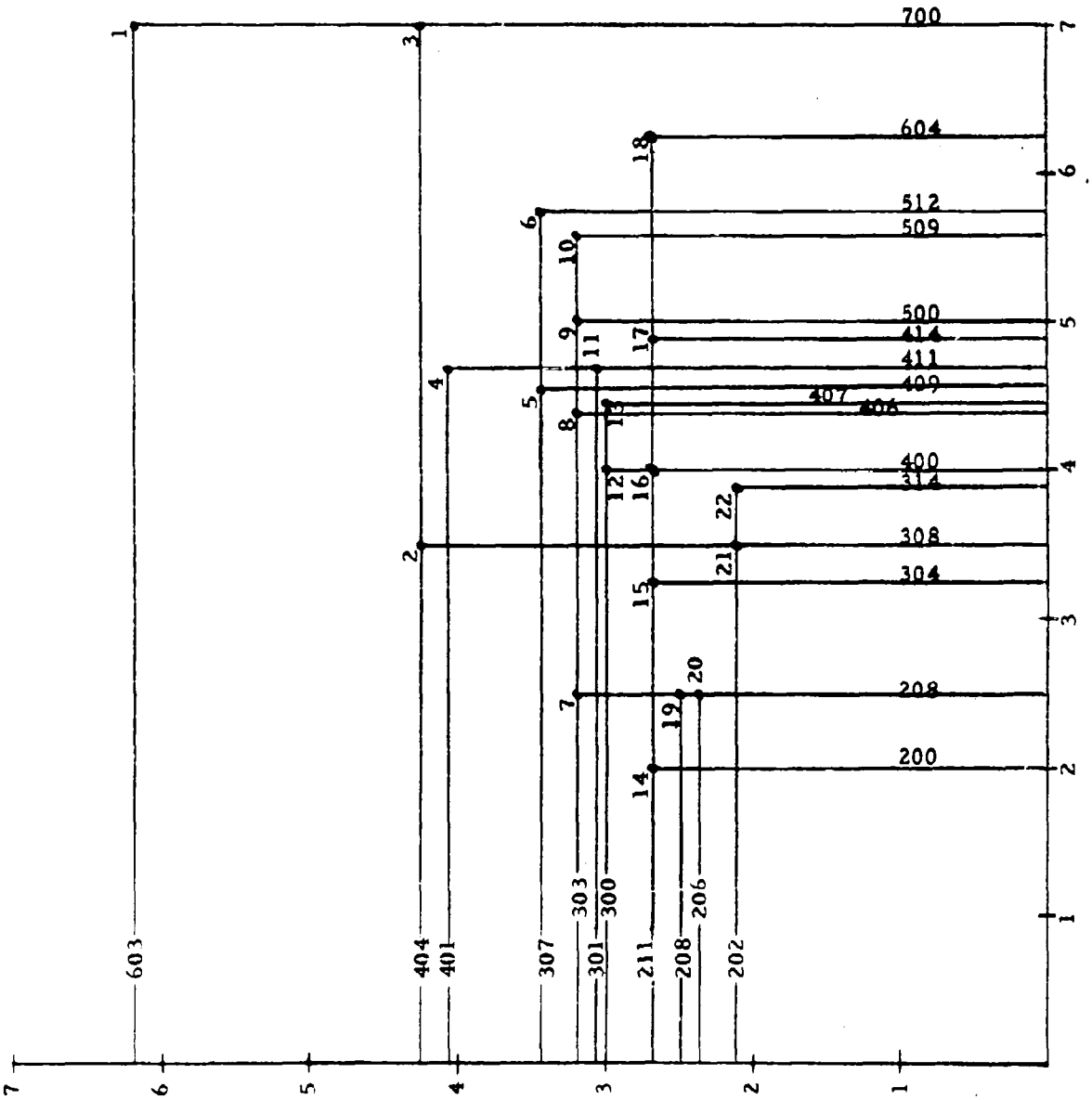
While federal planning has provided for a basic supply of water and survival biscuits to be stocked in public shelters, it would seem prudent for every individual to have their own private food supply available for use in times of emergency, either natural or nuclear.

Canned goods presumably are the easiest type to store and conform to shelter requirement. Stocks may be used regularly and replenished. Such renewal would then assure freshness at all times. The shelf-life of the survival biscuits, under normal conditions, is five years. Canned goods have a shelf-life of at least two years, are easily obtained and easily stored.

In selecting the type of foods for stockpiling, personal preference and the following additional suggestions may be considered:

CAN SIZES PER 100 PORTIONS

FOR HOMOGENEOUS PRODUCTS*



* Directions for using this chart appear on page 59a.

EXHIBIT B-5

CANS PER 100 PORTIONS

FOR HOMOGENEOUS PRODUCTS *

	Nom.	Fl. Oz. Can	Portion Size Fl. Oz. — Cans per 100 Portions				
			1	2	4	6	8
1	10	96	1.00	2.00	4.00	6.26	8.35
2	N	21	4.76	9.05	19.00	28.60	38.00
3	3C	46	2.18	4.35	8.70	13.00	17.50
4	2-1/2	26	3.85	7.70	15.40	23.10	30.80
5	2	18	5.56	11.10	22.20	33.33	44.30
6	2C	25.3	3.95	7.90	15.85	23.75	31.70
7	N	8.8	11.40	22.70	45.50	68.00	91.00
8	303	15	6.66	13.33	26.66	40.00	53.33
9	N	18	5.56	11.10	22.20	33.33	44.30
10	303C	21	4.75	9.50	19.00	28.50	38.00
11	IT	16	6.25	12.50	25.00	37.50	50.00
12		13	7.70	15.40	30.80	46.20	61.60
13	300	13.5	7.40	14.80	29.60	44.40	59.20
14	N	5.75	17.40	34.80	69.50	104.00	139.00
15	827	8.0	12.50	25.00	50.00	75.00	100.00
16	1	9.5	10.50	21.00	42.00	63.00	84.00
17	211C	12.0	8.33	16.66	33.33	50.00	66.66
18	N	16	6.25	12.50	25.00	37.50	50.00
19	N	5.5	18.20	36.30	72.60	109.00	145.00
20	N	5.0	20.00	40.00	80.00	120.00	160.00
21	62	5.8	17.25	34.50	69.00	103.50	138.00
22	N	6	16.67	33.33	66.66	100.00	133.33

* Directions for using this chart appear on page 59a.

Exhibit B-6

Directions for using the charts found in Exhibit B-5 and Exhibit B-6 on pages 58 and 59 are as follows:

1. Place the can to be measured upright on the bottom line so that its outer edges are touching the bottom line and the right-hand line.
2. Read from right to left along the bottom line to determine the line touched by the outer edge of the can. This measures the diameter of the can.
3. Mark this line lightly with a pencil.
4. Now place the can on its side with the bottom edge touching the bottom line so that you may measure the height of the can.
5. Reading up the right-hand line scale, determine the height of the can.
6. Mark this line lightly with a pencil.
7. From step 3, follow the line marked up the page to where it meets the line marked in step 6.
8. Find the code number at the intersection of the two lines.
9. Turning to Exhibit B-6, find the code number listed on the left-hand side of the table.
10. Reading from left to right, you will find the identification and size number of the can, its volume in fluid ounces, and the number of cans required to serve 100 portions of one, two, four, six and eight ounces.

EXPLOSION OF MENU - 1 WEEK

	1 B	1 L	1 D	2 B	2 L	2 D	3 B	3 L	3 D	4 B	4 L	4 D	5 B	5 L	5 D	6 B	6 L	6 D	7 B	7 L	7 D	Total
4 oz. Fruit Juice	1						1			1						1			1			5
Count crackers	3	7	9	4	5	6	6	5	7	7	5	5	7	7	1	6	4	8	7	6	8	123
1 oz. Jam	1						1	1		1			1			1			1			7
8 oz. Coffee	1	1	1	1	1		1	1	1	1	1	1	1	1		1	1	1	1	1	1	19
1 tsp. sugar	1	1	1	1	1		1	1	1	1	1	1	1	1		1	1	1	1	1	1	19
1/2 oz. Evap. milk	1	1	1	1	1		1	1	1	1	1	1	1	1		1	1	1	1	1	1	19
1 oz. Peanut butter		1																		1		2
2 oz. Deviled Ham			1																			1
4 oz. Tomato juice				1									1									2
1 oz. Marmalade				1																		1
6 oz. Pork & beans					1																	1
8 oz. Vegetable soup						1																1
8 oz. Ovaltine						1									1							2
8 oz. Tomato soup								1														1
2 oz. Tuna Fish									1													1
3 oz. Corned beef hash											1											1
8 oz. Asparagus soup												1										1
2 oz. beef stew														1								1
8 oz. Cr. Mushroom soup															1							1
2 oz. Vienna sausage																		1				1
8 oz. Barley soup																					1	1
6 oz. Spaghetti																	1					1

EXHIBIT B-7

EXHIBIT B - 8.

ORDER LIST (Recap - 14 days)

			Size	Conversion Units/100 oz.	Cans	Cases
Biscuits	Count	33, 333		. 215	72	12
Juice						
Fruit	Ounce	4, 000	3C	2. 18	87. 2	7
Tomato	Ounce	1, 600	3C	2. 18	35	3
Soups						
Vegetable	Ounce	1, 600	211x400	7. 70	123	5
Tomato	Ounce	1, 600	"	7. 70	123	5
Asparagus	Ounce	1, 600	"	7. 70	123	5
Mushroom	Ounce	1, 600	"	7. 70	123	5
Barley	Ounce	1, 600	"	7. 70	123	6
Meats & Meat Substitutes						
Deviled Ham	Ounce	400	211x200	17. 4	70	3
Pork & Beans	Ounce	1, 200	300x500	5. 56	67	3
Tuna Fish	Ounce	400	303x208	11. 4	46	2
Corned Beef Hash	Ounce	600	300x407	7. 4	45	2
Beef Stew	Ounce	400	404x308	4. 76	19	1
Vienna Sausage	Ounce	400	208x208	18. 2	73	3
Spaghetti	Ounce	1, 200	300x407	7. 4	89	4
Spreads						
Jams	Ounce	1, 400	8 gr. oz.	17. 6	246	10
Peanut Butter	Ounce	400	12 gr. oz.	9. 35	37. 4	1. 5
Marmalade	Ounce	200	8 gr. oz.	17. 6	36	1. 5
Beverages						
Coffee	Ounce	3, 800	10 gr. oz.	8 oz/tsp	30. 4	1
Milk	Ounce	1, 900	300x400	7. 70	146	6
Other						
Sugar	Tsp.	3, 800		1 lb/tsp		38#

1. Store small size, one-meal-only cans of food, since left-overs are a sanitation and health problem.
2. Salty and heavily-spiced foods should be avoided as they will increase thirst.
3. Where possible, foods selected should have a low protein content and high caloric value.
4. Containers should be easy to carry, non-bulky, and similar in size.
5. The food should be palatable whether served hot or cold.

While all nutritional authorities may not agree on the selection of foods for a survival diet, two fundamentals have been established; first, water is more essential to the human body than food, and second, protein intake requires adequate fluid intake to prevent renal failure.

Under the provisions of the National Shelter Stocking Plan, federal authorities have established that a survival ration of 10,000 calories contained in specified biscuits and fourteen quarts of water will sustain an individual for the expected shelter stay without excessive hardship. It is recognized, however, that this diet may be at best a psychological challenge to anyone, and especially to someone under stress.

A modest supplementation of this diet should significantly improve the morale of an individual thrust into a fallout shelter under emergency conditions. Studies have shown that hot food is preferred to cold food, that variety is desirable, and that foods to which a person is accustomed will receive a better reception.

The following survival menu has been designed with the above conclusions in mind, while still meeting known physiological needs. To the basic ration of survival biscuits, three spreads have been added. Items may be selected according to personal preference, but should include two portions of jam or jelly, one portion of cheese, and one portion of peanut butter daily. A portion is considered to be 2 tablespoons full. The fluid intake should be increased to approximately two quarts daily, and may be in the form of coffee, tea, milk, juices, soft drinks, or any beverage.

Suggested Daily Menu

Breakfast	Lunch	Dinner
8 survival biscuits	8 survival biscuits	10 survival biscuits
1 oz. jam	1 oz. peanut butter	1 oz. cheese spread
8 oz. instant coffee	8 oz. inst. coffee	1 oz. jam
1/2 tb. evap. milk	1/2 tb. evap. milk	8 oz. inst. coffee
1 ts. sugar	1 ts. sugar	1/2 tb. evap. milk
		1 ts. sugar

Total daily calories: 1403

Total 14-day calories: 19,642

The above items may be conveniently stored in your own "8-Pac Food Kit" in the following containers:

1 5-3/4 lb. tin of survival biscuits (390 biscuits)
3 12 oz. glass jars, assorted jellies and jams
1 #1 2 oz. glass jar peanut butter
1 14 oz. glass jar cheese spread
1 13 oz. can evaporated milk
1 2 oz. jar instant coffee
1 improvised jar of sugar, 1/2 lb. contents

Other minimum supplies necessary to complete the food kit would include:

1 can opener	1 Sterno stove #25 (cost - 99¢)
1 cup for coffee	5 canned heat (cost 19¢ & 39¢ each)
12 plastic spoons	

Cost of food: 60¢ per day, or $8.40

Other supplies: $4.00, including stove and fuel

Total cost: $12.40

Weight: 12 pounds

b. Reception of Food at Entry

Undoubtedly, occupants will bring food to the shelter. * In fact, they should be so encouraged, provided the food they bring conforms to the "Requirements for Food", See Section B - 1.

A food pack is suggested: - See "Stockpiling Food for Individual Emergency Use".

1. To bring to a designated shelter
2. To bring to a non-designated space.

1 5-3/4 lb. Tin of Survival Biscuits (390 biscuits)
3 12 oz. glass jars, assorted jam or jelly
1 1 lb. 2 oz. glass jar peanut butter
1 14 oz. glass jar cheese spread
1 13 oz. can evaporated milk
1 Improvised jar of sugar, 1/2 lb. contents.

* The Governor of New York State appeared on the radio, suggesting that shelter occupants bring four or five days supply of food. He did not specify what kind.

All of the food, except such as might have medical significance, should be delivered to the shelter management. Some of this food will be perishable, and should be delivered to the shelter occupants as soon as possible to prevent spoilage or food poisoning. Nothing of a perishable nature should be kept beyond 24 hours. Non-perishable food, in cans, jars, or tins must be evaluated in terms of portions. To do this, "read" a can on the Chart in Exhibit B - 5, and record with a marking pencil indicating the number of portions contained. If circumstances permit, this should be recorded and tabulated. For food in glass jars, the total fluid ounces contained should be determined and counted, or a close estimate established.

If crackers are in tins, a cracker count should be made from the marking on the tins. Use the conversion tables for cocoa, coffee and sugar.

All of these supplies should be compiled in a separate list to be added to the inventory to enable the food manager to determine issues in light of the anticipated stay in the shelter.

Very possibly, adequate storage space will not be available, and some improvisation is necessary. Possibly, too, storage conditions may not be desirable. More perishable items, such as cocoa or chocolate in cardboard containers should be stored in dry areas and used early in the shelter life. Very probably food brought into the shelter will not be in long life containers, which will in turn present a problem of both storage and control. Separate those items such as tin cans of the same size which can be reasonably stocked. Empty some of the existing cases of any canned foods which can be stocked, and use the empty cases for non-stocking items. By shifting alternate

courses of cases of canned goods, a whole case can be removed at intervals, providing pigeon holes for non-stacking items. Stack as high as possible, avoiding placing glass containers more than a slight distance above the floor, or form low benches around the room affording benches for occupants. To maintain control, all can openers and knives should be in the possession of the management.

(1) Mechanics of Reception - Each can size should be determined from "Cans per 100 Portions" and the nearest number of integral ounces written on the side in marking crayon. It is necessary only to mark a type can.

Divide contents into the following categories:

(2) NON-PERISHABLE ITEMS

a. Juices - Fruit and Tomato - 4 fl. oz. contents per portion.
b. Soups - 4 fl. oz. contents per portion
c. Meats & Meat Substitutes - 3 fl. oz. per portion
d. Spreads - 1 fl. oz. per portion
e. Vegetables - 2 fl. oz. per portion
f. Beverages (see conversion)
g. Other - List

The list should result in an evaluation of the number of portions of each product. See Inventory List. Chapter V.

(3) PERISHABLE ITEMS - Collect and deliver the entire inventory to occupants within two meals. Destroy the remainder,

unless expert opinion can be brought to bear on retention of specific items. It is, of course, improbable that any perishable food will be left over.

Summary

The function of the food manager as a menu planner will be limited, especially where the federal ration only is to be used. The admission of a variety of supplementary foods will permit some variation in menus and add the responsibility of insuring a degree of caloric balance in them. Particular attention should be given to the proper feeding of infants.

Since many food managers will have had little if any experience with balancing diets, tables are provided showing daily menus with the size of the portions and their caloric value indicated.

Tables are also presented by which the food manager can blow up the portions and calories indicated for a large group and maintain the appropriate balance developed in individual servings. Instructions are given for compiling an order list of supplies at the market showing the size, conversion unit and the number of cans or cases required. This order list, if preserved, can be used as a basis for the inventory list that will be required.

III. SELECTION AND DESIGN OF EQUIPMENT

1. Basic Methods of Heating
2. Equipment
    a. Major Equipment
        (1) Tables
        (2) Water vessels
        (3) Cooking vessel or can heater
        (4) Can opener
        (5) Refuse cans
        (6) Hand dip
        (7) Drip pans
    b. Minor Equipment
        (1) Cups
        (2) Spoons
        (3) Paper bags
    c. Miscellaneous Equipment
3. Equipment Size
    a. Heaters
    b. Size of Vessels related to heater.

III. Selection and Design of Equipment. Once the menu is known it is then pertinent to pursue the means of preparing the selected menu. It is the purpose of the following material to suggest a number of various ways in which this may be accomplished.

Emphasis is placed on portability of and storage space for equipment. Such emphasis overshadows complete adaptability of equipment so that where funds and space permit, as in designed shelters, better configurations could result. It is presumed that most shelter space in the immediate future will be otherwise used during peace times, and that portability and ease of storage will therefore be of paramount importance.

It is further presumed that private or community funds must be provided for any devices which extend the water and food service beyond the federal ration, and that in different parts of the country various groups will solve these problems in various ways.

1. Basic Methods for Heating. The basic concept involves a vessel or vessels, each heated by its own heater. In one case, the bottom of the vessel for beverage heating should be slightly above table height, while the top of the vessel for heating food should be at slightly above the table height. Where the energy source is electricity, thus exposing no hot flames, a table, acting as a support for the vessels as well as a "cafeteria" counter and a barrier, should be located parallel to a wall, and about 2'6" from it. The ideal distance is 3'6" to 4'0" if space permits.

In the event that open flames are used, it is better to employ two tables, one supporting the vessels to be placed against the wall and the second one to be parallel to it at 2'6" distance.

The space arrangements must accommodate the heating devices, provide for opening cans, disposal of waste, space for servers, and isolation of sewers from recipients. A suggested layout, using electricity as an energy source appears in Exhibit B - 9.

Serving Table - 100 Persons

Server D - Heats cans - Removes with Lifter - Passes to Server C

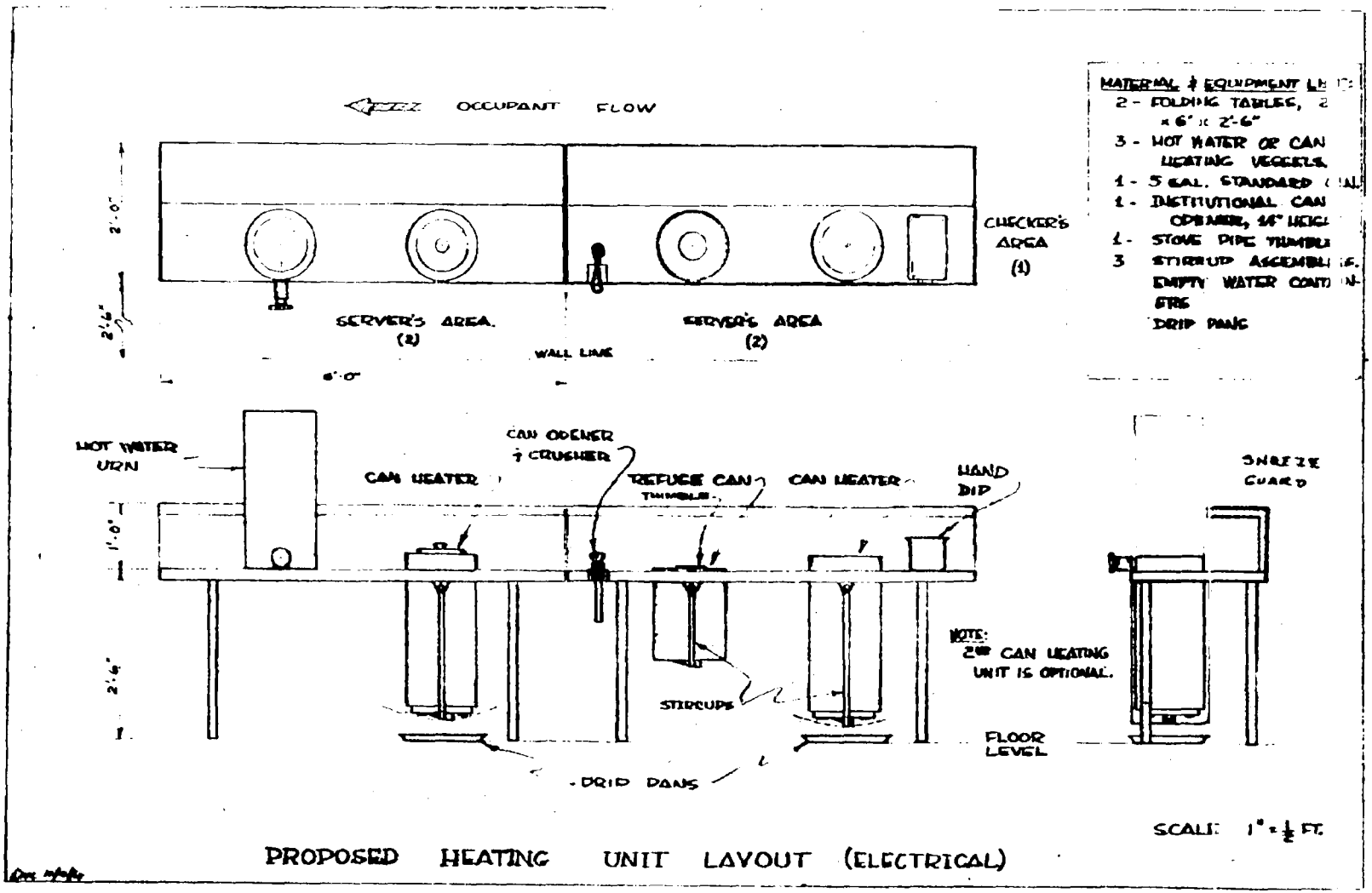
Server C - Opens Cans - Passes to Server B

Server B - Portions into Cups and Serves or Passes to Server A

Server B - Returns Empty Cans to Server C, who inverts on Paper Towel, Cutting out bottom and crushes.

Server A - Adds hot water to portions received from Server B, or dispenses hot water for coffee.

Server A - Issues cold water when hot water is not in demand.



PROPOSED HEATING UNIT LAYOUT (ELECTRICAL)

Exhibit B-9

2. Equipment. Equipment may be broken down in major, minor and miscellaneous groups.

a. Major Equipment

(1) Tables are folding, and should be rugged. They are pierced where necessary to accommodate heaters, refuse can and energy services. They should collapse for storage. A sneezeguard and counter should be provided to permit easy service and to keep occupants from bodily interfering in the food dispensing process. Furthermore, such a counter provides support for lighting during food service.

(2) Water vessel

(a) This should be a cylindrical device with a drain-off on the bottom, with removable top. It should be insulated. Corrosive surfaces are to be avoided. Such devices are currently available through distributors of commercial kitchen equipment manufacturers.

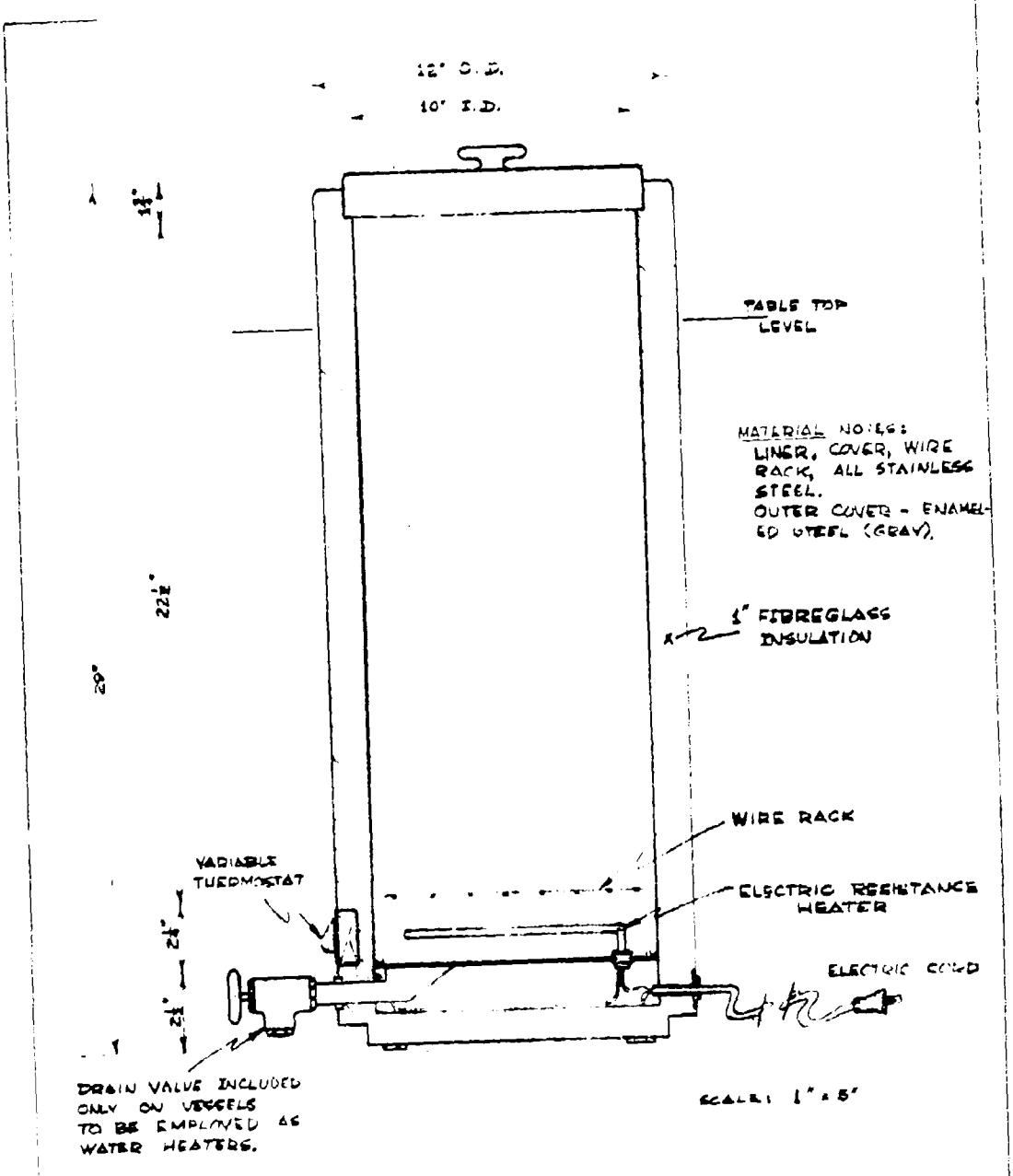
(b) As a second choice of an uninsulated device, a form of common stock pot may be used.

(c) An alternative arrangement might well be a small (6 gallon) domestic water heater if electricity or gas is used as a fuel. This will require some plumbing alterations to permit filling by hand. Such a device requires knowledge that it is filled before applying heat, or be protected against burn-out.

(3) Cooking vessel or can heater - This should be a cylindrical device with removable top. No drain-off is required, but arrangements must be available to remove cans from hot water. Several are possible, ranging from tongs to a false rack in the bottom which can be raised by chains or rods along the sides. Do not employ a center rod, which will interfere with the placing of cans.

See Exhibit B - 10.

EXHIBIT B-10



VESSEL FOR HOT WATER, OR FOR HEATING CANS

(ELECTRICAL)

(4) Classification of Can Openers. One of the most essential items of equipment needed in fallout shelters is the humble can opener. Since the bulk of the food supplies stocked will be packed in tins and jars, it is imperative that the type of opener selected will operate efficiently on all varieties and sizes of containers.

The openers examined may be classified as follows:

Class I - The "butterfly" type is hand-operated, having a single blade. The blade extends 1/4" below the top of the can while the opposite end doubles as a bottle or jar opener. It will open all cans at a moderate speed and produce a smooth edge. This type is relatively inexpensive and is universally available. See Exhibit B - 11.

Class II - Hand-operated and compact, without the conventional handle. Will open all cans very slowly and produce a reasonably smooth edge. This is a very small compact opener, found in Survival Kits. It is illustrated in Exhibit B - 11.

Class III - This is stationary, attached to either table top or wall, and may be electric or hand-operated. The can is punctured, held, and rotated by external engaging teeth. It will open all cans quickly and smoothly except those with elevated flanges, such as Survival biscuit cans. It is available at kitchen suppliers.

Class IV - This is the normal, cheap, hand-operated knife type of opener which will open all cans slowly, leaving a very rough edge. Must be used with care.

Class V - Punch opener for canned liquids only.

After extensive testing, using cans of varying shapes, sizes and flange elevations, it was found that the Class III opener was the most efficient, except for opening biscuit tins having a high flange. The Class III bench type was found to be superior to the wall type, as the latter does not always extend far enough away from the wall to accommodate large cans. Some of the government supplied survival biscuits are packed in tins having a diameter of more than nine inches, and could not be opened by this type.

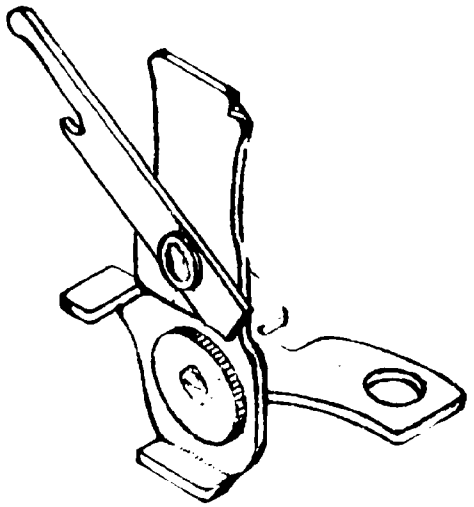
There were two minor objections to the Class I opener; it is not as speedy as the Class III and it is not stationary. Its performance, however, is satisfactory on all size cans.

Class II is a new, very small and compact can opener designed for survival kits. See Exhibit B-11. It will open any can, although slowly and somewhat laboriously.

Class IV openers, while functional, produce ragged edges and are difficult to manipulate. These must, therefore, be considered inferior to Classes I, II, and III.

Class V openers are specifically designed for use with cans containing liquids only.

5. Refuse Can - The refuse can may well be a standard 5 gallon drum, similar to those which contain paint. It should be fitted to the tables as shown, and water and sanitary chemicals placed in it to receive empty cans. If it can be equipped with a tough plastic liner, so much the better, for then the water and chemical mixtures can be poured off into the liner which replaces the filled one.



SKETCH OF "BUTTERFLY TYPE" CAN OPENER

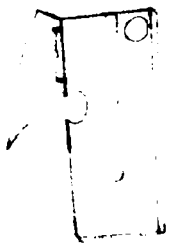


EXHIBIT B-11

SURVIVAL KIT
CAN OPENER

(6.) Hand Dip - A small container of water and containing germicidal chemicals should be available in which food servers can dip their hands to prevent spread of any infection and to promote cleanliness.

(7.) Drip Pans - should be provided under the can heaters to protect the floor. When such spillage occurs, the drip pans can be emptied into the refuse pan.

b. Minor Equipment

(1) Cups - One of two choices exists. The occupant will be issued a cup which he will retain or have stored for him. Paper cups of 8 oz. capacity, suitable for holding hot liquids will be provided. In this event, a suitable portable cup-rack should be provided. This will hold the tubes or cartons of cups more or less upright with the rims down in such a position that the server may readily remove one. Cups should always be flattened when disposing of them.

(2) Disposable spoons - can be supplied to occupants when any element of the menu requires spoons. Otherwise, a single more permanent spoon should be issued to each occupant, which he will retain.

(3) Paper Bags - should be available to each occupant in which to store his cup, spoon and other personal effects, as well as some foods which might be issued under very crowded conditions. Bear in mind that women do not have pockets and that hopefully the possessor of a bag containing assorted articles

may find a place to store it. This storage spot may well be an area on the floor. The food manager, incidentally, should caution occupants against allowing the bags to get wet.

c. Miscellaneous Equipment

(1) Serving spoons of known volume capacity will be required.

(2) Rubber covered asbestos gloves will be necessary to handle hot cans

(3) Means for removing cans must be provided, either in the form of tongs or a false bottom which can be raised.

Considered Can Sizes (A)				Internal Diameter of Vessel equals (at least) Diameter of Can x 3						x 5	From Can Dimensions	
Nom	Dimension		Fl. Oz.	211a 801b	300 900	303 909	307 1005	401 1203	404 1212	211 1307	Computed Volume Fl. Oz.	Computed Volume Cu. In.
Nominal and Decimal Equivalents per Can				Cans Per Layer and Ounces Per Layer								
1	211	400	9.5	7c	8	9T	9	15	16	19	12.70	23.0
	2.6875	4.0000		66.5d	76.0	85.5	85.5	142.5	170.0	180.5		
-	300	407	13.5	5	7	7	8	12	14	14	17.25	31.2
	3.0000	4.4375		67.5	94.5	94.5	108.0	162.0	189.0	189.0		
-	303	406	15	4	4	7	7	9	11	12	19.20	34.[illegible]
	3.1875	4.5750		60.0	60.0	105.0	105.0	135.0	165.0	180.0		
2	307	409	18	3	4	5	7	8	9	10	23.50	42.5
	3.4375	4.5625		54.0	72.0	90.0	126.0	144.0	162.0	180.0		
2-1/2	401	411	26	1	3	3	4	7	7	8	33.50	60.5
	4.0625	4.6875		26.0	78.0	78.0	104.0	182.0	182.0	208.0		
3T	404	700	46	1	2	3	4	5	7	7	55.00	99.5
	4.2500	7.0000		46.0	92.0	138.0	184.0	230.0	322.0	322.0		

a - Can Diameter
b - Container Diameter - Minimum
c - Number of cans contained in one layer
d - Fluid ounces contained in cans per layer

(A) - Considered Can Sizes - Selected from Table 24
Recommended can (tin) sizes and uses
Issued by U. S. Department of Commerce
June, 1949
AND
Canners Association
Purchase and Use of Canned Foods, Home Economics Section
American Can Company, 100 Park Avenue, New York City

Note 1 - All diameters may be "tight". Actual diameter should be increased by 1/4".

Note 2 - Measurements conform to standard can measurement notation.
307 = 3-7/16" = 3.4375"

For 100 Servings - 400 ounces in can

RELATION BETWEEN HEATING VESSEL AND
OUNCES OF FOOD HEATED IN VARIOUS SIZE CANS

EXHIBIT B-12.

Diameters and Working Depths of Water of Vessels to Heat 100 4-Oz. Portions of Food in Cans

Vessel Diameter = 801 (8.0625)

Can Diameter	Layers/400 oz.	Round Off	Working Depth
211	6.0	6.0	24.0
300	5.9	6.0	26.5
303	6.65	7.0	30.6
307	7.4	8.0	32.7
401	15.4	16.0	65.0
404	8.7	9.0	36.5
NO			

Vessel Diameter = 900

211	5.25	6	24
300	4.22	5	22.3
303	6.65	7	30.6
307	5.55	6	27.4
401	5.10	6	28.1
404	4.35	5	35.0
Volume 2220			
9.6 Gallons			
NO			

Vessel Diameter = 909 (9.5625)

211	5.3	6.0	24
300	4.2	5.0	22.18
303	3.8	4.0	17.5
307	4.45	5.0	22.8
401	5.1	5.0(?)	23.44
404	2.9	3.0	21
Clear Volume			
1720 Cu. In.			
7.44 Gallons			

Vessel Diameter = 1005 (10. 3125)

Can Diameter	Layers/400 oz.	Round Off	Working Depth
211	4. 7	5	20
300	3. 7	4	17. 7
303	3. 8	4	17. 5
307	3. 18	4	18. 3
401	3. 82	4	18. 8
404	2. 18	3	21

1760 Cu. In.
7. 5 Gallons

E - Z 500 - Inside Diameter = 10", Free Height = 14. 25".

Vessel Diameter = 1203 (12. 1875)

211	2. 82	3	12. 0
300	2. 47	3	13. 3
303	2. 97	3	13. 1
307	2. 78	3	13. 7
401	2. 2	3	14. 0
404	1. 74	2	14. 0

Vessel Diameter = 1212 (12. 75)

211	2. 36	3	12. 0
300	2. 12	3	13. 3
303	2. 43	3	13. 1
307	3. 47	3	13. 7
401	2. 20	3	14
404	1. 24	2	14

1800 Cu. In.
7. 75 Gallons

Vessel Diameter = 1307 (13. 4375)

211	2. 210	3	21
300	2. 12	3	21
303	2. 22	3	21
307	2. 22	3	21
401	1. 925	2	14
407	1. 24	2	14

EXHIBIT B - 13
Continued

RECAPITULATION

Of Diameter and Working Depths of Water

In Vessels to Heat 100 4-oz. Portions

Of Food In Cans

	Container Diameter	Diameter Inches	Maximum Height * Inches	Container Volume Gal.	Can Size Influencing Height
1	801	8.0625	65**	14.40	401
2	900	9.0000	35	9.6**	404
3	909	9.5625	24	7.44	401
4	1005	10.3125	21	7.60	300
5	1203	12.1875	14	7.00	401
6	1212	12.7500	14	7.75	401
7	1307	14.4375	21	14.80	401

* Effective water height is height of water necessary to cover cans above false bottom.

** Eliminated because of excessive value.

EXHIBIT B - 14

3. Equipment Size

a. Heaters - Since many heater sizes are commercially available, it is important to be able to select the optimum size. This choice is completely associated with the size of cans which are to be heated, and is dictated by the number of cans which will be accommodated by the diameter of the heater. It is of value, therefore, to provide tables of vessel sizes and can capacities.

For example, food should be heated only in tin cans, whose sizes are smaller than 401 x 411 (4-1/16" diameter x 4-11/16" height). Suppose it is desired to heat one hundred 4-fluid ounce portions of food in number 2 cans. Suppose that the diameter of the vessel is 1203 (12-3/16"). Reference to Exhibit B-12 indicates that 8 cans per layer can be accommodated, providing 144 fluid ounces or 36 servings. Three layers will be required to provide the desired 100 portions. From the table, the height of a number 2 can is 409 (4-9/16"). Thus three layers will require a vessel whose working water depth is 13-9/16". If no vessel of this height is available, then two such vessels will be required. These computations are simplified in Exhibits B-13 and B-14. It appears in B-14 that the container's height will be 14" for all size cans equal to or less than a No. 2-1/2 can.

Suppose a specific size vessel is available, how many portions of 4 ounces each in varying can sizes will be accommodated? (See Exhibit B-14).

b. Size of Vessel Related to Heaters

Continuing the example of the five gallon can as a vessel, a heating unit must be obtained to heat it, and such a unit must conform

to the size of the vessel. For example, there are readily available table-model gas stoves from mail order houses, but their size is 10" x 10" for a single burner and 10" x 26-1/8" for a two burner, which is not large enough to support a vessel of this size. Hence, either a larger size heating unit must be discovered, which may be difficult, or a support provided permitting use of the readily available gas unit; or a smaller vessel must be employed. The point is made that merely the acquisition of a heat source and a vessel is not enough, and either compatible sizing is required, or some mechanical adaptation made.

Thus, a five gallon common can might be used as a vessel to heat food. It is 11.25" in diameter x 13" high. Its effective water height is about 12". Referring to Exhibit B-14, this vessel will heat at least 52 portions of 4 fluid ounces each, and hence two containers will be required for 100 occupants. A heater for each is also required.

Summary

All equipment including that for heating should be portable if possible to permit the use of the shelter for other purposes during the pre-occupancy period. For this reason, folding tables well built to withstand frequent moving and yet equipped to operate as serving tables, are advised. Minor equipment such as can openers and utensils should be carefully selected to insure service, save washing, and prevent breakage. Where food or water are to be heated, the size of the heater should be selected in terms of the size of the cans that are in storage. An analysis of the tables will indicate the method by which portions can be determined by various sizes of containers. The heater can then be adjusted to the number of portions required at a given feeding.

Special Case Showing Capacity of 2 Vessels

10" Inside Diameter x 14" Working Depths of Water

To Contain 100 4-Oz. Portions

No.	Can Size	Height of Cans Decimals	Layers/vessel Theor.	Pract.	x 2	Adequate	Excess Layers	Cans	Fl. Oz.	4 Oz Portions
1	211 x 400	4. 0000	3. 50	3	6	Yes	0	0	0	0
	300 x 407	4. 4375	3. 16	3	6	Yes	1	7	94. 5	23
	303 x 406	4. 3750	3. 20	3	6	Yes	2	14	210. 0	52
2	307 x 409	4. 5625	3. 07	3	6	Yes	1	10	180. 0	45
2-1/2	401 x 411	4. 5875	3. 00	3	6	Yes	1 ?	3	78. 0	18
3T	404 x 700	7. 0000	3. 00	2	4	Yes	1	3	138. 0	36

EXHIBIT B - 15.

EXHIBIT 3 - 16.

NUMBER OF 4 OUNCE PORTIONS IN CANS

CONTAINED IN CYLINDRICAL VESSELS OF VARIOUS SIZES

VESSEL SIZE *		CAN SIZES													
		211 x 400			300 x 407			303 x 406			307 x 409			401 x 411			
Inches Diameter	Inches Height	Ounces/ Layer	N	Portions	Ounces/ Layer	N	Portions	Ounces/ Layer	N	Portions	Ounces/ Layer	N	Portions	Ounces/ Layer	N	Portions	Minute
9	10	76.0	2	38	94.5	2	48	60	2	30	72	2	36	78	2	39	3(
	12		3	57		2	48		2	30		2	36		2	39	3(
10	12	85.5	3	65	94.5	2	48	105	2	52	90	2	45	78	2	39	3(
	14		3	65		3	71		3	79		3	58		3	58	5
11	12	85.5	3	65	108.0	2	54	105	2	52	126	2	63	104	2	52	5
	14		3	65		3	81		3	79		3	94		3	78	6
12	12	55.5	3	65	162.0	2	81	105	2	53	126	2	63	104	2	52	5
	14		3	65		3	121		3	79		3	94		3	78	6
	16		4	85		3	121		3	79		3	94		3	78	7
13	14	142.5	4	143	189.0	3	142	165	3	123	162	3	121	182	3	136	12
	16		4	143		3	142		3	123		3	121		3	135	12
	18		4	143		4	189		4	180		3	121		3	135	12
14	16	180.5	4	180	189.0	3	142	180	4	180	180	3	135	208	3	156	13
	18		4	180		4	189		4	180		3	135		3	156	13
	20		5	225		4	189		4	180		4	180		4	208	18

* There are other size vessels

IV. SELECTION OF ENERGY SOURCES

1. Kinds
    a. Electric
    b. Gas
    c. Kerosene
    d. Charcoal
2. Layout
    a. Electric
    b. Gas
    c. Kerosene
    d. Charcoal
3. Cost of equipment and Installation
    a. Electric
    b. Gas
    c. Kerosene
    d. Charcoal
4. Heat Supplied to Shelter Environment
    a. By vessels
    b. By system
    c. By fuels
5. Other Factors
    a. Ventilation requirements
    b. Fire Hazard
    c. Ease of Installation
    d. Recapitulation

Summary

IV. Selection of Energy Sources

1. Kinds - A number of schemes may be adapted for the application of energy to heating water and food. The most promising fuels seem to be:

a. Electrical Power

1. From utilities or central standby units

2. From unit generators for water and food service only.

b. Bottled gas

c. Kerosene

d. Charcoal

2. Layout - The layout will be affected by the fuel employed.

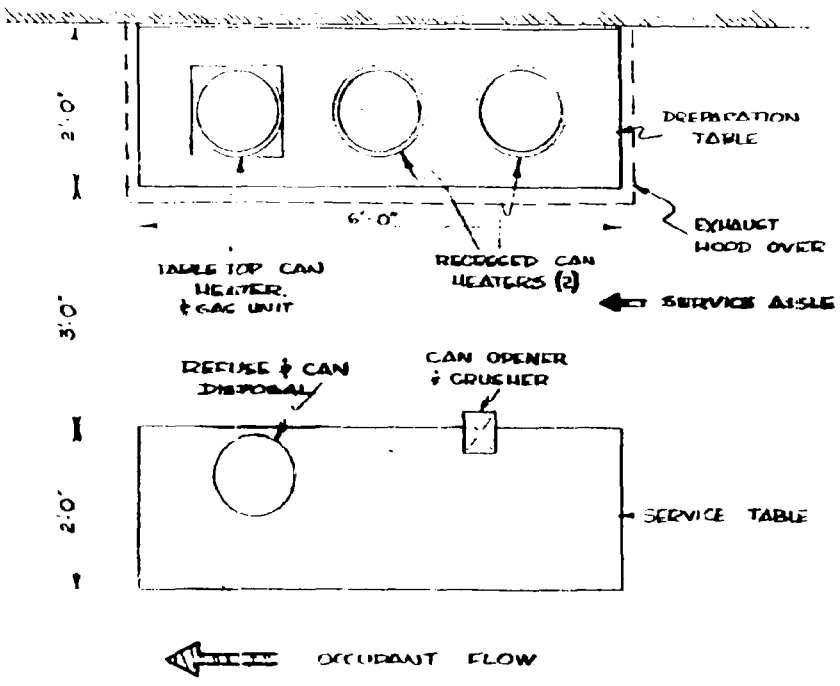
a. Electricity, when employed, permits a layout as shown in Exhibit B-9. Note that while a ventilating hood is shown, it is not necessary when electricity is the fuel. There is reasonable expectancy that normal utility supplies of both electricity and gas will be available during shelter occupancy, thus forcing upon the food services planner the risk involved in not providing either self sufficient power sources or alternate power sources. Whether or not the risk is assumed is the responsibility of those involved in planning. One of the criteria of foods selected for shelter use is the possession of a high degree of compatability when unheated, so that the choice between heating and not heating is basically concerned with morale, and then only in the cold months.

b. Gas - A layout for gas appears in Exhibit 20. In general, this differs using two tables, permitting the gas appliance to be located on a back bar away from the occupants, and against a wall permitting good anchoring. Note that gas supply tanks are not shown, but must be located.

c. Kerosene - will offer no problem different from gas, except that gravity tanks must be provided for fuel storage, preferably buried outside the shelter. See Exhibit B-18.

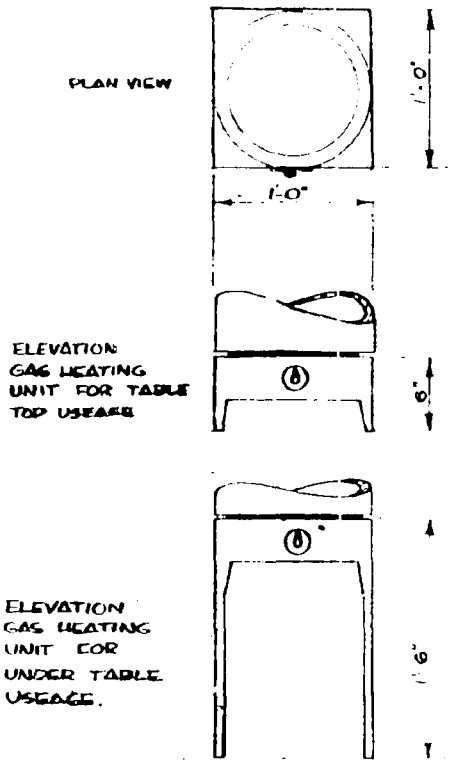
d. Charcoal - burning will undoubtedly require some homemade devices to burn it. The general layout however will be the same as for gas or kerosene. See Exhibit B-19.

EXHIBIT B-17



PLAN VIEW

GAS HEATER DETAIL



PROPOSED LAYOUT FOR GAS FIRED HEATING UNITS.

EXHIBIT B - 18

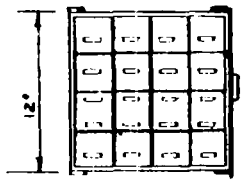
PLAN VIEW:-
SAME LAYOUT SCHEME AS GAS-FIRED UNITS, WITH EXHAUST HOOD OVER BACK BAR.

UNIT DETAILS:
SAME CONFIGURATION AS GAS-FIRED UNITS WITH ADAPTATION FOR USE OF LIQUID FUEL(KEROSENE) IN PLACE OF GASEOUS FUEL.

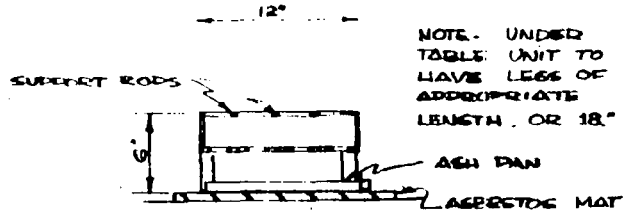
PROPOSED LAYOUT FOR KEROSENE FIRED HEATING UNITS

EXHIBIT B-19

DETAILS - CHARCOAL UNIT
(TABLE TOP)



PLAN VIEW



SECTIONAL ELEVATION

NOTE - UNDER TABLE UNIT TO HAVE LEGS OF APPROPRIATE LENGTH, OR 18"

PLAN VIEW:
SEE PLAN LAYOUT FOR GAS FIRED HEATING UNITS. CHARCOAL LAYOUT TO BE IDENTICAL.

PROPOSED LAYOUT FOR CHARCOAL FIRED HEATING UNITS

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3. Cost of Equipment and Installation

A choice may exist in the use of electrical energy. Commercial or standby power may be used, or unit generators may be employed. A further choice exists as to whether water for beverages is to be heated or whether both water and food is to be heated.

In presenting the cost of equipment, all of these cases will be considered for four fuels.

a. Electricity
   (1) For heating water only
      a Commercial or standby power
      b Unit Generator
   (2) For heating water and food
      a Commercial or standby power
      b Unit Generator

b. Gas
   (1) For heating water only
   (2) For heating water and food

c. Kerosene
   (1) For heating water only
   (2) For heating water and food

d. Charcoal
   (1) For heating water only
   (2) For heating water and food

e. Recapitulation

a. Electricity

(1) For heating water only

a Commercial or standby power

	5 gallon Electric Institutional Heater	6 gallon Electric Domestic Heater Adapted
	1500 watts - 120 volts	1250 watts - 120 volts
Device	$120.00	$ 38.50
Wiring	25.00	25.00
Adaption Faucet and fill		60.00
TOTAL COST	$145.00	$123.50

b Unit Generator

Add to above:		
Generator - 2500 W-6.3 HP	400.00	
Exhaust Connection	100.00	
Storage tank - 550 gallon	90.00	
Gravity Feed installation	30.00	
Excavation costs	75.00	
Wiring	100.00	
	$795.00	$795.00
TOTAL WITH UNIT GENERATOR	$940.00	$918.50

(2) For heating water and food

a. Commercial or standby power

		5 gallon Electric Institutional Heater	6 gallon Electric Domestic Heater Adapted
		1500 watts - 120 volts	1250 watts-120 volts
The total cost for heating water only from a-1 was		$145.00	$123.50
Add:			
Device - 5 gallon Institutional Heater	$120.00		
Wiring	15.00		
		135.00	135.00
TOTAL COST OF WATER AND FOOD		$ 280.00	$ 258.50

b. Unit Generator

Add to Above:			
Generator - 3500 W.		484.50	
Exhaust connection		100.00	
Storage tank - 550 gallon		90.00	
Gravity feed installation		30.00	
Excavation costs		75.00	
Wiring		100.00	
		$ 879.50	$ 879.50
TOTAL COST - WATER AND FOOD		$ 1159.50	$ 1138.00

b. Gas

(1) For heating water only

	30 gallon Domestic Hot Water Heater Modified	5 gallon urn with unit 10,000 BTU/h burner under
Heater	$ 34.95	
Modification - Hand fill and faucet	60.00	
Exhaust Ducting	100.00	$200.00
3 Tanks of Gas	30.00	30.00
Piping	50.00	50.00
Urn		60.00
Stove		7.50
TOTAL COST	$324.95	$347.50

(2) For heating water and food

Add to above:		
1 Urn	60.00	60.00
1 Stove	7.50	7.50
2 Tanks	20.00	20.00
Exhaust Ducting	50.00	50.00
TOTAL COST - WATER AND FOOD	$462.45	$485.00

c. Kerosene

(1) For heating water only

Stove	$ 8.50
Urn or Pot - 5 gallon	60.00
Storage Tank - Gravity, 20 gallon	60.00
Installation	30.00
Exhaust	200.00
TOTAL COST	$ 358.50

(2) For heating water and food

Add to above:

Stove	8.50
Urn or Pot - 5 gallon	60.00
30 gallon Tank - Difference	20.00
Exhaust	50.00
TOTAL COST WATER AND FOOD	$ 497.00

d. Charcoal

(1) For heating water only

Charcoal Pan Burner - constructed	$40.00
Urn - 5 gallon	60.00
Exhaust	200.00
TOTAL COST	$ 300.00

(2) For heating water and food

Add to above:

Charcoal Pan Burner	40.00
Urn - 5 gallon	60.00
Exhaust	50.00
TOTAL COST - WATER AND FOOD	$450.00

2. Recapitulation

	Heating Water	Heating Water and Food
a. Electricity		
a Commercial or standby		
(1) Institutional Heater	$145.00	$280.00
(2) Domestic Heater	123.50	258.50
b Unit Generator		
(1) Institutional Heater	940.00	1,159.50
(2) Domestic Heater	918.50	1,138.00
b. Gas		
(1) 30 gallon Domestic	324.95	462.45
(2) 5 gallon Urn	347.50	485.00
c. Kerosene	358.50	497.00
d. Charcoal	300.00	450.00

NOTE: Cost of exhaust ducts and hoods vary.

4. Heat Supplied to the Shelter Environment - General.

Heating water and food releases heat to the shelter. Under summer conditions this may provide such an adverse effect that heating cannot be done without affecting the possibility of survival. On the other hand, under winter conditions, heat released to the atmosphere may be most welcome. It is assumed that hot beverages and hot food are significant contributions to morale, and should be provided except under the most adverse conditions.

It is of significance, therefore, to explore the quantities of heat released by the various methods employed so that their contributions to shelter discomfort may be evaluated.

The heat will come from the vessels themselves, simply because they contain hot water, and independently of how they are heated. In addition, the efficiency of the application of the fuel will determine how much more heat is added. A further consideration is that of ventilation. If equipment can be located very close to exhausts for the shelter, much of the heat created by the cooking will move directly out and not contribute to the general atmosphere. Not all possible combinations are explored but those which do appear should be sufficient.

Heat Content of Fuels

The following heat contents of fuels and the efficiency of their application are presumed:

Type	BTU's/unit	Efficiency
Electricity	3415 BTU's/KWH	100%
Low Pressure Gas (100 lb. cyl.)	21,600 BTU's/LD	40%
Kerosene	140,000 BTU's/gal. (U.S.)	40%
Charcoal	14,000 BTU's/lb.	40%

a. Heat supplied by vessels - the heat transferred to the shelter by a hot vessel used to heat water which may be made into coffee or to heat food in cans is dependent upon the following factors:

(1) Geometry of vessel

(2) Temperatures of water and surrounding air

(3) Thermal characteristics of vessel, i.e., surface, insulation and material

(4) Air movement across surface of vessel

b. Unused heat supplied by application of fuel - these systems are applicable:

(1) Electric heater immersed in vessel

(2) Bottled gas flame with vessel over it

(3) Kerosene burner

(4) Charcoal flame with vessel over it

(5) An electric hot plate with vessel over it. This will deliver more heat to the shelter than an immersion heater, and the assembly will be almost as high in cost.

(6) A gasoline stove with vessel over it. Gasoline produces a significant hazard in the shelter and rugged equipment is somewhat unavailable.

c. Total heat.

The total BTU's per hour (maximum) delivered to the shelter is the sum of the heat rates delivered by the vessel or vessels and that delivered by the application of the fuel. In addition, a significant factor is the presence of ventilation which would provide for the removal of unused heat before the heat can be distributed to the shelter. Consequently, it becomes necessary to determine approximate values for these two separate sources.

a. Heat supplied by vessel - determinations

Condition. Rate of heat input - this is assumed to be at a rate of 1500 watts or 5100 BTU's/hour. Other rates may well result. However, this value is typical for the can heater shown in Exhibit B-10. Such a rate, if electricity is used, does not require heavy wiring.

(1) Geometry of vessels - for purposes of illustration, a vessel of the following dimensions is selected:

Inside diameter	- 10"
Cutside diameter	- 12'
Cutside height	- 30'
Inside effective water height	- 22'
Volume of water content	- 1 cubic foot
Surface computed	- 9.42 sq. ft.

Such a device is selected for an example because its capacity for food is of a high order (see container sizes) and is available with an immersion heater. (See Application schemes for details of the device).

(2) Temperatures - it is desirable to reach a temperature of the water within the vessel of 170 degrees F. It is further assumed that, before heating, both water and food will be at a temperature of 70 degrees F. and that the food will be heated to 160 degrees F. Two cases will be considered. Case I being an insulated vessel and Case II being an uninsulated vessel.

(3) Thermal characteristics of vessels.

Case I - Insulated

The vessel is of stainless steel and insulated with 1" of Fiberglass with a k value of 0.27.

It is desired to know the sensible heat load imposed upon the shelter in the use of such a device. Where hot food or liquids are consumed by the occupants, the transfer of heat to surrounding air is subordinate to the body's control and does not contribute to shelter heat load. For example, if one pound of water at 170°F. is allowed to cool to 70°F., it will contribute 100 BTU's to the shelter load, while an individual standing beside it will contribute perhaps 400 BTU's per hour. If, however, the water is drunk by the individual, the contribution of the water becomes zero and the individual's contribution remains unchanged.

It is necessary, then, to deal only with the heat transfer through the surfaces of the device during the period of both heating and cooling of the actual contents.

Computations of this character, if accurate results are to be obtained, are difficult. However, estimates may readily be made, resulting in values higher than actual, which if acceptable, guarantee the results of actual practice.

The maximum rate of heat transfer for steady state conditions through the surfaces of the vessel is determined as follows:

$$\text{BTU/hr.} = UA(T_1 - T_0)$$

where

$$\frac{1}{U} = \frac{1}{f} + \frac{x}{k}$$

$f = 1.5$, $x = 1"$, $k = 0.27$, $U = 0.228$

$T_1 - T_0 = 170 - 70 = 100$

BTU/hr. = 0.228 x 9.42 sq. ft. x 100 = 214 BTU's/hr.

Case II - Uninsulated

It is convenient at this time to determine the maximum rate of heat transfer for steady state conditions for an uninsulated vessel.

In this case, $U = 1.5$

and

BTU's/hr. $= 1.5 \times 9.42 \times 100 = 1413$ BTU's/hr.

In both cases, radiation transfer is neglected.

Case I

Returning to Case I, it is required to know the time for bringing water and food up to 160°F.

Heating and cooking time - The heating time will depend upon:

(1) The temperature of the water bath

(2) The size of the can

(3) The material in the can, divided for ready rough reference into:

a. Quite liquid, such as green beans

b. Semi-liquid, such as tomatoes

c. Heavy non-liquid, such as baked beans.

A test with simulated equipment was made. The data appears in Exhibit B-20. It also appears in graphic form in Exhibit B-21, "Corrective Curves for Rates of Heating," and are corrected for an assumed temperature rise (TR) of 70°/ hr. appearing in Exhibit B-22, "Experimental Data on Rate of Heating."

A COMPARATIVE TIME CHART

Temperatures

	0	10	20	30	40	50	60	70	80	90	100	110
Pork & Beans	71	72	80.5	92.5	121	137	146	153.5	159	162	164	
Tomatoes	71	73	82.5	102.5	123	138	148	154.5	161	164	168	
Green Beans	71	102	142.5	162.5	169	169	168	168.0	168	168	168	
Water	71	132	162.0	172.0	170	170	170	170.0	170	170	170	

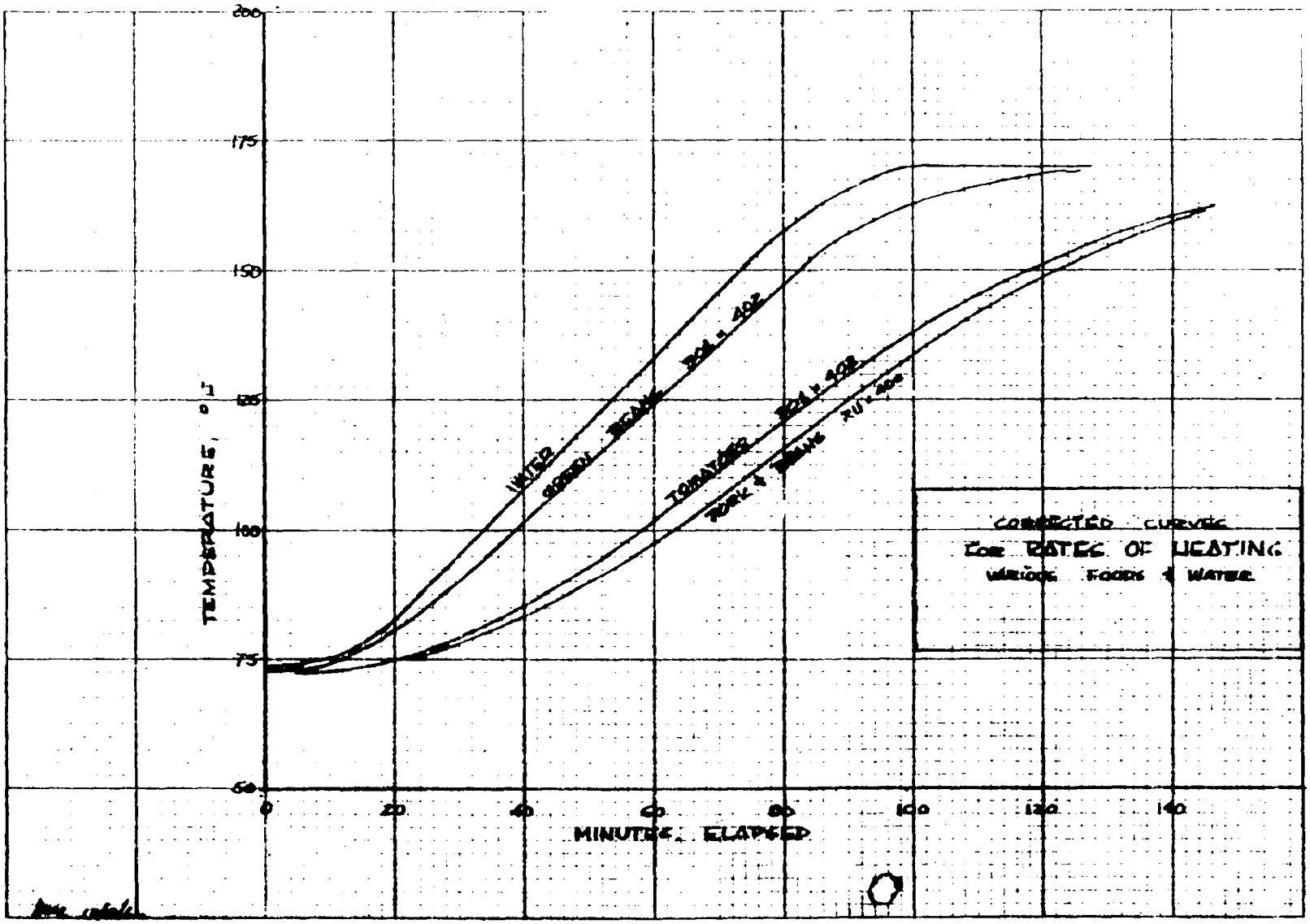
Data for Heating and Cooking Time

Cans used		Diameter and Height	Size
Pork & Beans	1 lb.	2 7/8 x 4 1/4"	214 x 404
Green Beans	15 1/2 oz.	3 1/16 x 4 1/8"	301 x 402
Tomatoes	1 lb.	3 1/16 x 4 1/8"	301 x 402

Exhibit B-20

Exhibit E-21

P 107



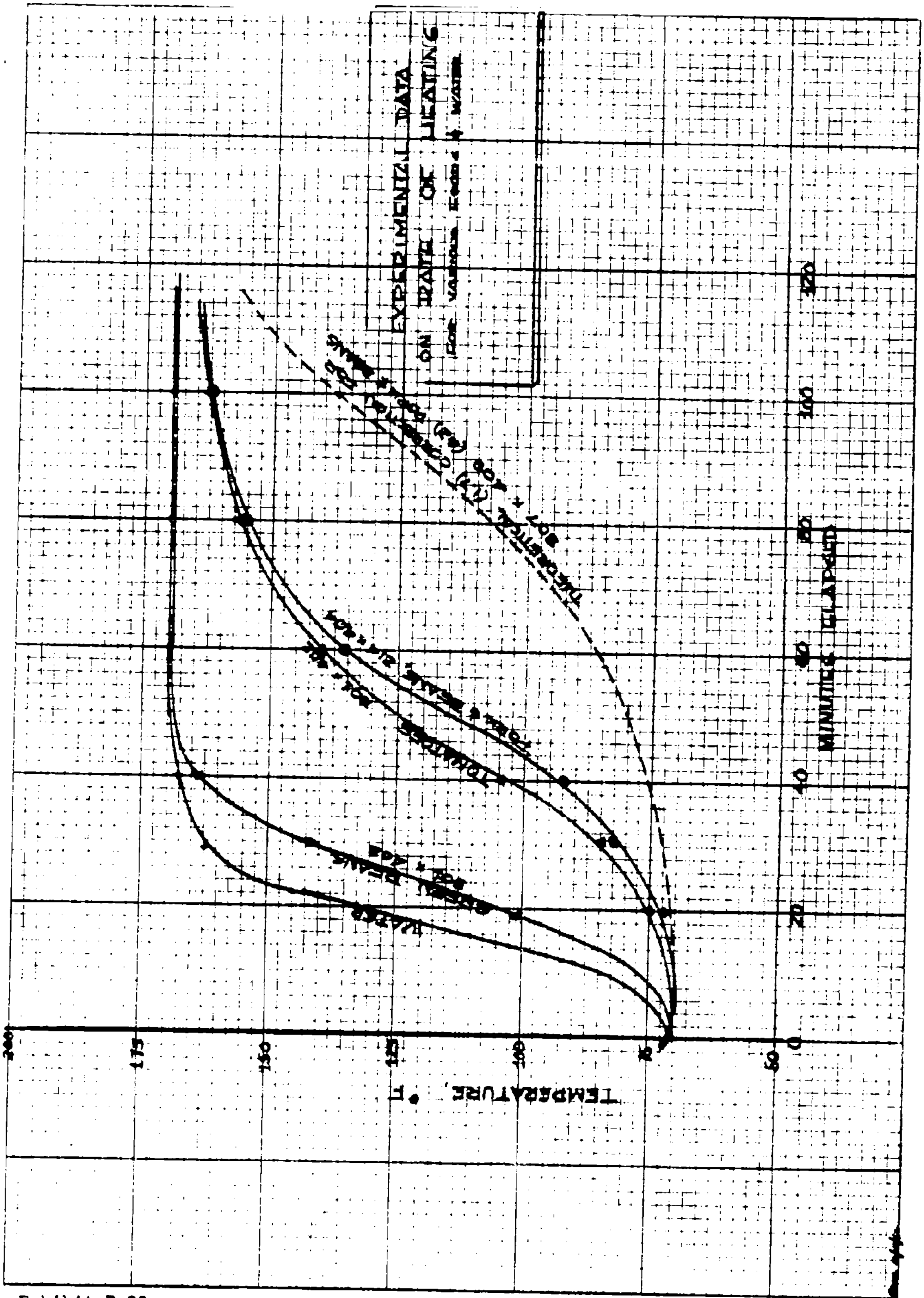

EXPERIMENTAL DATA
ON RATE OF HEATING
MINUTES ELAPSED
TEMPERATURE, °F
0
20
40
60
80
100
120
50
75
100
125
150
175
200

Exhibit-B-22

	Water	Quite Liquid	Semi Liquid	Non Liquid
Temperature Rate Rise	79°/hr.			
Total Heating Time - Min.	90.0	88.00	130.00	130.00
Total Heating Time - Hrs.	1.5	1.47	2.17	2.17*

The Temperature Rate Rise (TR)

The temperature rise rate is

62.4 lb./cu.ft. water x 1 cu.ft. x TR

0.228 x 9.42 (See Equation 1) x TR = 5100 BTU's/hr

$$TR = \frac{5100 \text{ BTU's/hr.}}{62.4 \times 2.14} = 79^{\circ} \text{ hr.}$$

At the end of the first hour, the maximum heat rate to the shelter will be:

0.228 x 9.42 x 79° = 169 BTU's/hr.

In the second hour, the maximum heat rate will be:

(From Equation 1) 214 BTU's/hr.

*The time elapsed for the non-liquid contents results from the test of a smaller can than was the case for the other two products. The effect of an increase in can size will produce a longer time, which might be estimated at 2.5 hours.

BTU's per hour during cooling time

This situation occurs after cans are removed from the vessel, and the water is allowed to cool down to room temperature. The water level in the container will be lowered and the hot surface of the vessel exposed to the room will be decreased, thus transferring heat at a lower rate. The vessel is presumed to have contained 35 cans, each of 34.6 cu. in. real volume (See Exhibit B-10) making a total of 1210 cu. in. The total volume of cans and water was 1 cu. ft. equal to 1728 cu. in.

Hence, the remaining water after removal of the cans equals 1728 - 1210 518 cu. in. This results in a new water height of 6.62 inches with a resulting surface exposure of 2.514 sq. ft.

The maximum heat rate for steady state conditions is:

$$BTU/hr. = U A (T_1 - T_o)$$

$$= 0.228 \times 2.514 \times 100 = 57.3 \text{ BUT's/hr.}$$

Recapitulation - Case I

Maximum rate - first hour	169 BTU's/hr.
Maximum rate - during cooking	214
Maximum rate - during cooling	57

Case II

Uninsulated Vessel

Although the geometry of the vessel will be different, due to lack of insulation, this will be neglected, and the transfer for steady state conditions will be computed only by changing the value of U.

From equation (1-a)

Maximum rate of heat transfer during cooking = 1413 BTU's/hr.

Temperature Rise Rate - (TR)

$$62.4 \times TR + 1.5 \times 9.42\ TR = 5100\ \text{BTU's/hr.}$$

$$TR = \frac{5100}{62.4 + 14.13} = 67.7 \quad \text{say} \quad 68^{\circ}/\text{hr.}$$

Maximum Rate - first hour

$= 1.5 \times 9.42 \times 68 =$ 957

Maximum Rate - cooling

Same 57

Cooking Time - Roughly this is extended by 79/68 = 116.5%

Recapitulation - Case I and Case II - Rate of Heat Delivered to Shelter by Vessels

	Insulated	Uninsulated
Maximum Rate - first hour BTU's/hr.	169	957
Maximum Rate - during cooking	214	1413
Maximum Rate - during cooling	57	57

Cooking Times - hours - not at maximum rates for full time

Water	1.5	1.75*
Quite Liquid	1.47	1.72*
Semi-liquid	2.17	2.52*
Non-liquid	2.30	2.68*

(4) Air movement across the vessel was assumed at 15 M.P.H.

*Obtained by multiplying the values for an insulated vessel by 116.5%.

b. Unused heat supplied by application of fuels.

Using the application efficiencies previously assumed and assuming that 5100 BTU's per hour will be supplied to the vessels at a constant rate, the results of a series of computations appear in Exhibit B-23.

c. Total heat rate to shelter

It remains to assemble the results of "Recapitulation - Case I and Case II" and those expressed in Exhibit B-23 to arrive at the "Total Heat Rate to Shelter." Only maximum values will be used, and they will be added. The results so obtained will not be correct but will, however, err on the side of safety. These results appear in Exhibit B-23a.

5. Other Factors in the Selection and Use of Fuels

a. Ventilation Requirements

If no spare ventilation is provided for the shelter and the density of the occupant population is beyond one per 40 or 50 square feet of floor space, it is very probable that cooking with an open flame would be dangerous. It must be recognized, too, that with unvented devices, CO_2 is also delivered to the shelter, which may cause considerable difficulties if ventilation is not adequate. More elaborate devices might well be used and ventilating hoods provided which, when operable, would remove most of the wild heat and gases. In a designed shelter, such refinement and provisions for ventilation might not be employed. However, in many instances, existing ventilating ducts might be available which would function by gravity, and, under these conditions, hoods should be provided.

EXHIBIT B-23

UNUSED HEAT DELIVERED TO SHELTER BY FUELS

ASSUMED DATA FOR VARIOUS FUELS

IN PROPOSED SYSTEMS - BTU's/HOUR

	Efficiency %	*** BTU's per Hour To Vessel	BTU's Supplied by Fuel	% Heat in Flue Gas	% Heat Latent	% Heat to Shelter Unvented	% Heat to Shelter Vented *	Heat to Shelter Unvented	Heat to Shelter Vented
Electric Electric Immersion Coil	100%	5100	5100	0	0	0	0	0	0
Bottled Gas	40%	5100	12750	14	7	60	39	7650**	4970
Oil (Kerosene)	40	5100	12750	15	5	60	38	7650***	4850
Charcoal	40	5100	12750	17	0	60	43	7650	5470

* Flue Gas and Latent

** 890 Latent

*** 765 Latent

**** Assumed

Notes: Multiply values above by 2 to determine cane for hot water and food.

With proper hood design, more heat can be removed.

EXHIBIT B-23-a

RECAPITULATION OF TOTAL HEAT RATE DELIVERED TO SHELTER
BTU's per hour

Fuels	Electricity		Gas		Oil		Charcoal		Totals
Insulated	214		214		214		214		
Vented	0	0	4970	4970	4850	4850	5470	5470	
	214		5184		5064		5684		Insulated and Vented
Uninsulated	1413	1413	1413	1413	1413	1413	1413	1413	
		1413		6383		6263		6883	Uninsulated and Vented
Unvented	0	0	7650	7650	7650	7650	7650	7650	
	1413		9063		9063		9063		Uninsulated and Unvented
Insulated		214		214		214		214	
		214		7864		7864		7864	Insulated and Unvented

NOTE - Maximum heat rate = 9063 - Uninsulated vessel - Unvented fuels other than electricty.

Minimum heat rate = 214 - Insulated vessel with oil immersion.

If electricity is used, no ventilation problem is created, except as the heat supplied to the shelter in summer may have to be removed. The conclusion may be expressed as follows:

Ventilation

Electricity - not required except heat in summer.

Gas - no problem if ventilation exists, except in summer.

Kerosene - same

Charcoal - same, but somewhat difficult to provide ventilation.

b. Fire Hazard

Enough is commonly known about these sources so that only general conclusions need to be stated:

Electricity - none

Gas - minor

Kerosene - significant but not restrictive

Charcoal - minor

c. Ease of Installation

(1) Electricity permits facile arrangement of equipment as well as protection against burns and open flames. As a result, one table can serve the combined purpose of serving counter and stove.

(2) Gas - on the other hand - uses an open flame requiring relegation of burners to an area which will not expose occupants to burns. At the same time, a serving counter is required in addition. It is possible that the total table area required for service with gas fuel may not be any greater than that required when electricity is used. Gas equipment should be ventilated, however, which ties the equipment to a specific location, not permitting any flexibility of movement. Since the tables used will be

light, any table supporting gas burning equipment should be placed against a wall and hopefully locked to it in some manner, so that the assembly will not be moved by pressure against it.

(3) Kerosene presents about the same problem as gas, but a much greater emphasis must be placed upon the rigidity of equipment so as to eliminate the danger of spilling. In the use of both gas and kerosene, flexible tubing should be used.

(4) Charcoal presents a difficult ventilation problem as well as some difficulties in handling the fuel. However, these are not of the first magnitude, and many people have had experience with charcoal.

d. The ease of installation of various fuels may be recapitulated as follows:

Electricity - easy
Gas - some problems
Kerosene - some problems
Charcoal - somewhat difficult

5. Comparison of Systems - Recapitulation

	FUELS				
	Electricity		Gas	Kerosene	Charcoal
	Commercial	Unit			
(3) Water and Food Cost of Equipment *	$280.	$1200.	$475.	$450.	$450.
(4-c) Heat Supplied by Fuel - BTU/hr.					
Vented	None **		9,940	9,700	10,940
Unvented	None **		15,300	15,300	15,300
(4-a) Ventilation	Not Required		Required	Required	Required
(4-b) Fire Hazard	None		Minor	Significant	Minor
(4-c) Ease of Handling	Easy		Some Problem	Some Problem	Somewhat Difficult

* Values are rounded

** 2 times volume from Exhibit B-23

Summary

A number of fuels may be used to heat water or food in a shelter when heat can be tolerated. The most promising are electrical power, bottled gas, kerosene, and charcoal. The advantages and problems of each are considered and the best method of using them described. The approximate relative cost of the various fuels are presented in table form.

The problem of the risk involved in raising the temperature in a closed shelter must be assumed by the food manager. The precautions and devices for determining changes are discussed and evaluated according to the different fuels. Other factors to be considered in the selection of fuels are ventilation, fire hazards and ease of installation.

V. Issuing and Inventories

1. Inventory list
2. Waste

V. ISSUING AND INVENTORIES

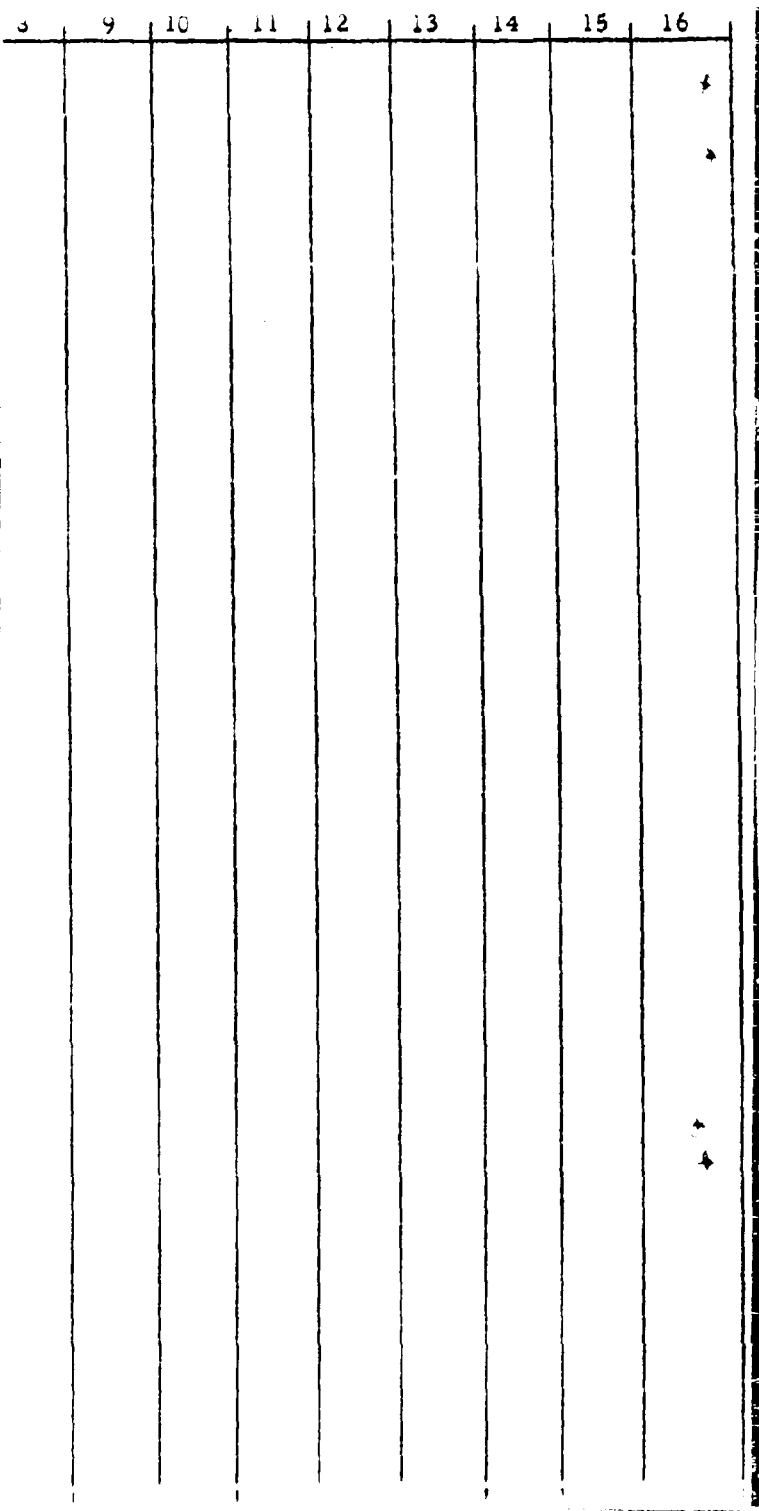
Before each meal, management makes a decision relative to quantities and varieties of foods to be offered. The variety depends upon what is available, the quantities depend upon the quantities available, and the expected stay in the shelter. Until some estimate of this stay is available, management should serve minimum quantities once the perishable foods have been consumed. Shelter experiences have indicated that when food is available in unrestricted quantities, early consumption is not high so no danger of lessening morale is involved. An exact count of occupants is available, so it should be possible to withdraw from stores almost an exactly needed quantity of food. Create such a list or menu and subtract the issue units from the inventory, showing the remaining inventory. (See "Inventory and Issue Sheets") and ("Running Inventory"). Report this inventory to management at least daily, showing total issue units available.

1. Inventory List - An inventory list can be written from the "Order List". Remember that some rounding off had to be done to reach full case lots, and consequently some adjustments have to be made. Of those items appearing in the inventory, it is wise to mark a typical can size with the fluid ounces it is expected to deliver, permitting a check on issuing at a later date. Obviously, a can so marked should be retained until last.

This inventory list should be maintained in such a fashion that additions can be made to it when occupants bring their own food.

ISSUE FROM INVENTORY

1	2	3	4	5	6	7	
	MEAL						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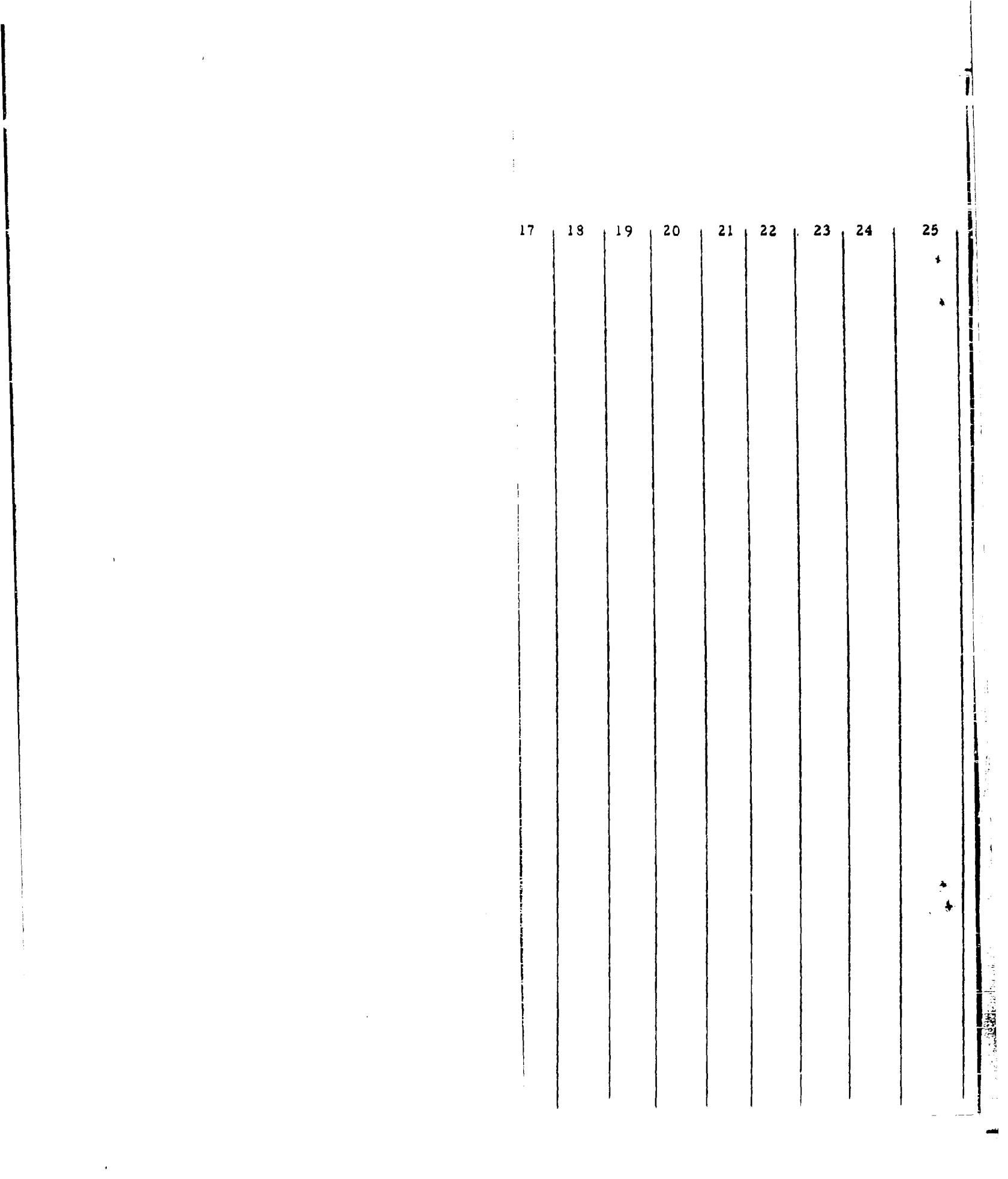
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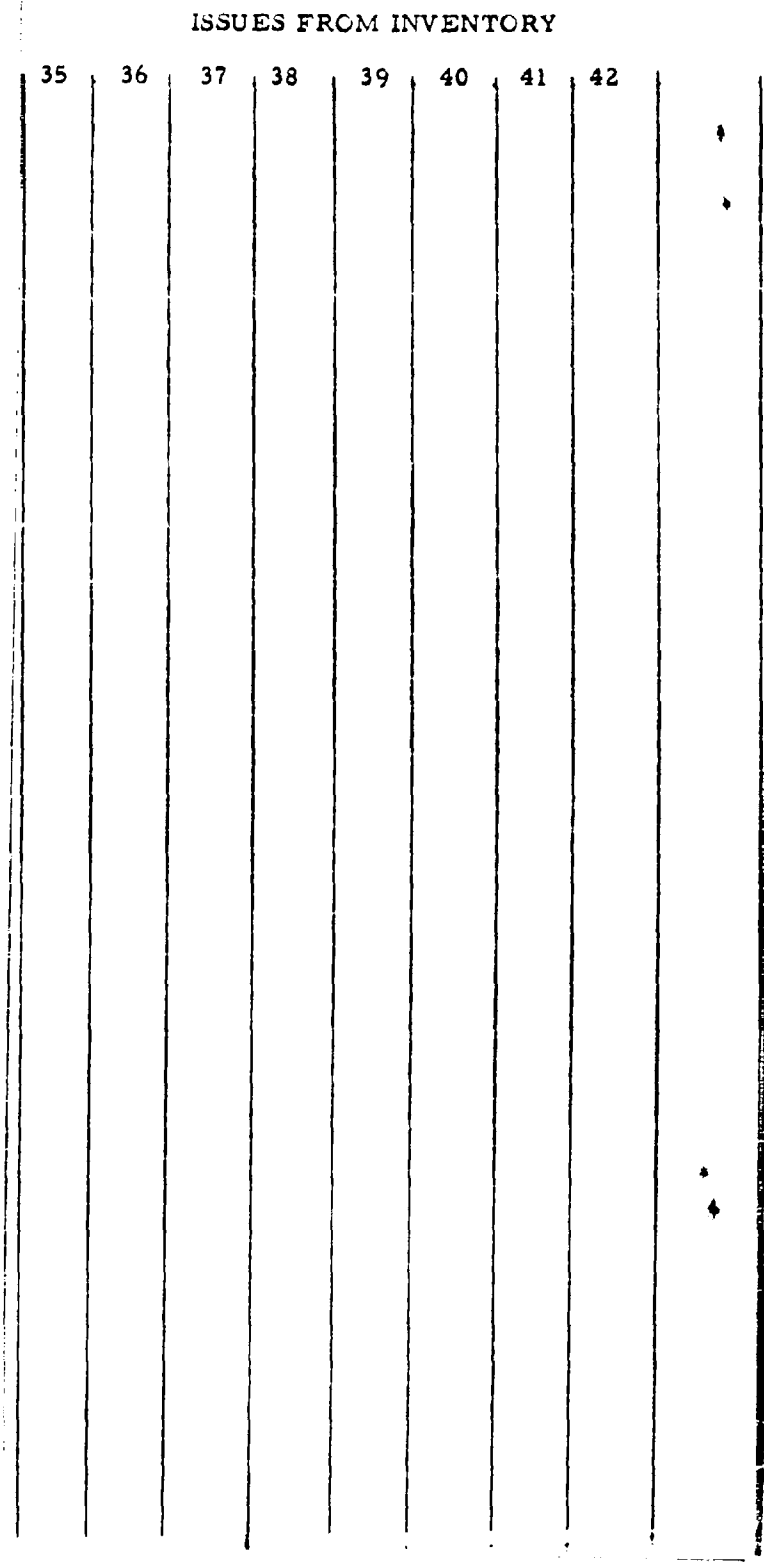
26	27	28	29	30	31	32	33	34


ISSUES FROM INVENTORY
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39
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41
42

Please turn book upside down.

INVENTORY LIST 1	2	3	4	5	6	7	8	9
Item	Issue Unit	No.	Size	Store Unit	No.	Issue Unit per Store Unit	Issue Unit per 100 Portions	Portions Size fl. oz.	Portions No.
Water	Cups	5,600	17.5 gal.	Drum	20.0	280	100	8	5600
	Cups	5,600	5.0 "		70.0	80	100	8	5600
TOTAL	Cups	11,200							
Biscuits	Count	33,350	-	Tins	72.0	465	.215	Vary	Vary
Juice									
Fruit	Cans	84	3C	Case	7.0	12	8.7	4 oz	965
Tomato	Cans	36	3C	Case	3.0	12	8.7	4 oz	414
TOTAL		120							
Soups									
Vegetable	Cans	120	211x400	Case	5	24	42	4 oz	286
Tomato	"	"	"	"	"	"	"	"	"
Asparagus	"	"	"	"	"	"	"	"	"
Mushroom	"	"	"	"	"	"	"	"	"
Barley	"	144	"	"	6	"	"	"	343
TOTAL		624							
Meats									
Deviled Ham	Cans	72	211x200	Case	3	24	34.8	2 oz	207
Pork & Beans	"	72	303x500	"	3	24	33.3	6 oz	216
Tuna Fish	"	48	303x208	"	2	24	22.7	2 oz	212
Corned Beef	"	48	300x407	"	2	24	22.2	3 oz	216
Beef Stew	"	24	404x308	"	1	24	9.05	2 oz	266
Vienna Sausage	"	72	203x208	"	3	24	36.3	2 oz	198
Spaghetti	"	96	300x407	"	4	24	44.4	6 oz	216
TOTAL		432							
Spreads									
Jam	Jar	240	8 gr. oz.	Case	10.0	24	17.6	1 oz	1360
Peanut Butter	"	36	12 gr. oz	"	1.5	"	9.35	1 oz	385
Marmalade	"	36	12 gr. oz	"	1.5	"	17.6	1 oz	204
Cheese	"		12 gr. oz	"	1.5	"	15.0	1 oz	?
TOTAL		312							
Beverages									
Coffee	Jar	24	10 gr. oz	Case	1	24	.80	1 tsp	300
Milk	Can	144	300x400	"	6	"	3.85	1/2 oz	3740
Other									
Sugar	Cups	80	8 gr. oz	Gal.	5	16	2.08	1 tsp	3850

EXHIBIT B-25

Examples of Computations.

1. Issue unit is known - cans.
2. Number of issue units computed

   No. storage units (4) x Issue Unit per Storage Unit (6)

   = 5 x 24 = 120
3. Size of can is known by measuring. See Exhibit B-5 211 x 400
4. Storage unit is known - case
5. Number of cases is known - by count
6. Issue unit per storage unit is known - by count

   24 cans per case.
7. Issue units per 100 portions is determined from Exhibit B-5, knowing <u>can size</u> (3) and <u>portion size</u> (8)
8. Portion size - predetermined
9. Computed by dividing <u>number of issue units</u> (2) by <u>Issue units per 100 portions</u> (7) and multiplying result by 100 rounding off to highest number.

$$\frac{120}{42} \times 100 = 285.71 = 286$$

Issues

Presume that the following menu will be served to 75 occupants.

	Portions	Units Per 100 Prtns.	Units Issue	Actual	Over
4 oz. Fruit Juice	75	8.7	6.52	7	+
3 Crackers	75	300	225	225	0
1 oz. Jam	75	17.6	13.2	13	-
8 oz. Coffee	75	.80	0.60	.60	0
Water	75	100	75	75	0
1 tsp. sugar	75	2.08 cups	1.56	1.6	+
1/2 oz Evap. Milk	75	3.85	2.88	3.0	+

Enter the actual issues in the proper place under Meal 1 as shown on "Issues from Inventory" and add the classes.

Running Inventory

Post the class totals under the appropriate columns of "Running Inventory" and subtract from the beginning inventory. Report these inventories to the shelter manager as required.

RUNNING INVENTORY

	Water	Biscuits	Juices	Soups	Meats	Spreads	Coffee	Milk	Sugar
Inventory	11,200	33,350	120	624	432	312	24	144	80
First Meal	75	225	7			13	0.6	3	1.6
Balance	11,125	33,125	113	624	432	299	23.4	141	78.4
Second									
Balance									
Third									

EXHIBIT B-26

Note that the running inventory is maintained in issue units of classes, which provides no direct evaluation of calories inventory. If such an evaluation becomes important, see the 'Table of Calories', which gives an approximate value per can.

However, the probabilities are very great that the problem will be the reverse, that a shelter stocked for fourteen days will be occupied for a period less than this, and that the daily issues or portion sizes can well be increased. It is suggested under these circumstances that the standard portions be maintained, but the number of portions per occupant be increased. For example, the menu for lunch on the third day might be revised:

	Original	Revised
Biscuits	600	900
Fruit Juice - 4 oz.	100	150
Jam - 1 oz.	100	150
Coffee - cup	100	150
Sugar - 1 tsp.	100	150
Evap. Milk	100	150

Such a procedure will permit an easy expansion of known and used values, rather than a re-evaluation of "Cans per 100 Portions."

2. Waste

Note further that in some instances issues are in excess of needs. Furthermore, exact delivery of portions will not be possible, so that either food is in opened containers and will be left over, or on the other

hand will run short. Either or both of two undesirable situations will therefore occur. Food should not be wasted, nor should partiality be shown. It would seem a fair way out of this dilemma would be to rotate the last group to be fed at each meal, giving them leftovers when they are available, or making up their lack of food with biscuits.

Summary -

A daily function of the food manager in the shelter is the determination of the quantities and varieties of food remaining to be portioned out to the occupants. The assignment of portions for a given meal will depend on the estimate of the duration of confinement and the exact count of people to be fed. For this purpose reliable inventories of the food and water remaining in storage must be kept current for his analysis. He must also report on his supplies daily to the general manager.

The inventory records begin with the order list that should have been filed with the food as purchased. Sample inventory lists are presented and described with forms on which running inventories may be kept. Where issues are in excess of needs due to the failure of some occupants to eat their meal, careful attention must be given to surpluses to avoid waste or partiality by allowing some persons to take the excess food or water.

VI. Preparation, Service, Distribution and Control

1. Imported foods.

2. Water

   a. Distribution of water

   b. 17 1/2 gallon units

   c. Dispersing methods

      (1) Elevate

      (2) Providing a stiff disk

      (3) Pouring

      (4) Decanting truck

      (5) Distribution

   d. Recapitulation of Water Containers

3. Food

   a. Packaging

   b. Methods of Portioning

4. Basic Federal Stocking. No heating facilities, crowding.

   a. Biscuits

   b. Candies

   c. Decisions

5. Distribution and control of water and supplementary food with heating facilities

   a. Hot liquids - beverages

   b. Coffee

   c. Soups

   d. Milk

   e. Other beverages

   f. Hot foods undiluted

6. Supplemental Stocking - Heating Facilities, crowding
7. Supplemental St ocking - No Heating Facilities, no crowding
8. Distribution
9. Food Flow Charts
10. Food Control

Summary

VI. PREPARATION, SERVICE, DISTRIBUTION AND CONTROL

Various methods of serving water and food and beverages may be employed. Where trained helpers standing behind tables such as those described can pass out measured portions to the occupants as they go by the table, the problem of distribution can be controlled and orderly. Checks can be made on each individual receiving a portion of food or beverage so that duplication can be avoided. Different sections or divisions of the shelter population could come to the serving table in a determined sequence to prevent long waiting lines. The food could be taken to their own areas for consumption in most cases.

If sleeping arrangements in a shelter do not require day and night shifts for the food division, the customary community routine of three meals in the day time should be followed. The eating rhythms of the group should not be upset more than necessary.

The ration for each day should be set by the food manager after careful evaluation of the remaining supplies and the current outlook for the duration of the confinement period. Where the fallout is very serious and does not seem to be clearing up satisfactorily, the possibility of post confinement feeding in the shelter should not be lost sight of. It is always possible that outside foods depended on in the post shelter period may be either destroyed or contaminated so that the shelter may have to serve as a food depot longer than anticipated.

The entire day's ration should not be passed out at one time even though crowded conditions would suggest such a procedure. Food that is not consumed at a given meal is always in danger of being wasted or bartered off thus creating either a sanitary or morale hazard.

The training and disciplining of the service personnel in dealing with rationed food deserves attention. Most of the staff will have had no experience with the distribution of rationed food. They will be under severe pressure to be partial to their handouts, especially as hunger and thirst develop. To surrender to such efforts on the part of some occupants would immediately arouse complaints and strife leading to turmoil. If persisted in, it would cause a breakdown of service. Every precaution must be taken by the food manager to insure impartiality. Portions must be carefully measured with no variations due either to carelessness or intent. People who have brought supplementary foods to the shelter to avoid strict rationing may create special problems of distribution. Hungry children will find it difficult enough to have to endure privations and would not understand differences in portions. Food supervisors will find it to their advantage to keep the occupants well informed of reserves and policies of distribution.

Because of the limitations on food and facilities and the complexity of the population, no ethnic or religious laws will be recognized in the preparation or serving of food as far as the food manager is concerned.

The storing of supplies of food other than the basic rations will

create complexities for the food manager. Before significant quantities of such supplementary foods are accepted for storage, the food manager or his representative should be assured that they have met the qualifications set forth earlier for the selection of shelter foods.

The preparation and service of food will need to conform to the prevailing conditions dictated by the degree of crowding, the provisions for heating water or food and the variety of menu items.

1. Imported Foods

If this is all that is expected to be available, there is still the presumption that some food supplies will be brought into the shelter. For this contingency a Class I can opener must be provided, or failing this a Class II opener. (See Exhibit B-11) Perishable foods must be served fast, with the general intent of equalizing caloric values and effecting complete consumption before spoilage occurs. Probably, unless reliable opinion is available, a safe rule to follow is to effect total consumption within 12 hours. The service of remaining imported canned goods should follow in general the procedures given in subsequent sections. The problem basically remains of distributing food and biscuits at specific times in metered quantities.

2. Water

a. The Distribution of Water

Because of its importance to survival, the preservation and distribution of water requires thoughtful consideration. The water supply will definitely determine the number of people who

can be admitted to the shelter and its equitable distribution will have much to do with the morale of the occupants. With a possibility of as little as one quart per person per day stored, as indicated by the basic stocking, the first effort of the food manager should be to supplement this by at least doubling the supply.

A second problem is the size of the containers used for storing water. Some of the vessels proposed are too large for easy manipulation and if they are found in a shelter, provision should be made for pouring from them into smaller containers for easier distribution. A five-gallon water can is about as heavy as most people would be able to pour from safely without undue spilling or injury.

b. Water - 17 1/2 Gallon Units

If water is in containers greater than five-gallon units, it cannot be transported in bulk and must be served from a central location. A barrier, in the form of a counter, should exist, between the occupants and the server. The water can be removed from the plastic containers by several means.

c. Dispensing Methods

(1) Elevate the water drum by placing it on top of another drum, either empty or full. Obtain the plastic dispensing spout and 10 iodine water purification tablets from the sanitation kit. Remove the drum cover, unwire the water bag spout, insert the dispensing spout, and wire in place, near the bottom or water end of the spout, leaving a few turns of wire loose and available.

Drop the water purification tablets through the dispensing spout into the water. After 5 minutes, insert one end of the siphon tube to the bottom of the water and agitate the tube to complete mixing of the dissolved tablets with the water. Lower most of the tube into the water and pinch the end tightly. Lift the tube, which is now almost filled with water until the water end is submerged about 6 inches, and bring the outside (pinched) end down over the side of the drum. When the pinch is removed, water will flow. Using the few turns of loose wire, wrap the water bag spout between the water bag and the dispensing spout tightly around the siphon tube. If the siphon tube is slightly longer than twice the height of the drum from which it is drawing water, practically all of the water will be delivered. The delivery end of the tube must always be 6 or 7 inches lower than the level of the water in the drum. The remaining water can be poured from the bag after the removal of the siphon tube. To stop the flow of water, turn the end of the siphon tube sharply backward and hold in this position with the plastic wire previously used for securing the top of the outer bag. If care is exercised to keep the outer end of the tube always lower than the water level inside the drum, and the inner end of the tube always submerged the siphon will operate until the water bag is almost empty.

(2) Providing a stiff disk of fiberboard or corrugated paper fitting inside the outside drum, pierced with a suitable center hole through which the neck or nozzle projects. Into the nozzle insert a rubber stopper pierced by a glass tube on both ends of which are rubber tubes, the inner of such a length as to readily reach about half way to the bottom of the container, the outer of a length twice the height of

the sides. Force (and it will be considerable) on the disk will force water into the tube which, when full, will deliver water by siphoning until the container is almost empty. A ring or base clamp on the tube will shut off the water when not in use. This device is shown in Exhibit B-27.

A more elegant way is to remove the air from the container by sucking on the tube with an aspirator or bulb, disconnecting the bulb after the tube is filled with water.

(3) Pouring

The container should be placed in an upright position on the floor, the top removed, the outer bag unfolded, the neck released, and the pouring nozzle inserted and secured. Examine the edge of the can for sharp protuberances which should be removed or avoided. Two men should stand on each side of the container while a third manipulates the nozzle. The container should be carefully tilted until water gently flows over the edge of the container (although in the plastic bag). Gentle delivery of water can be accomplished by raising or lowering the neck and nozzle. In this procedure water will be contained in the plastic bag outside of the container. The quantity of this water should be kept to a minimum of perhaps 2 quarts being replenished from time to time by again tilting the container. Under no circumstances should the container ever be placed in a horizontal position until the total remaining contents of the bag are in the order of 2 quarts. Premature horizontal positioning will result in the bag and water rolling out of the can completely, providing possibilities for rupturing the bag with consequent loss of water.

As the contents of the container decrease and the container must consequently be tipped more to the horizontal, thereby decreasing the height from the floor of the pouring nozzle, it is suggested, when the contents are about 2/3 gone, that the container be raised and set on either another full or previously emptied container to gain additional height.

When empty, the pouring nozzle is removed and used in the same manner for the next container.

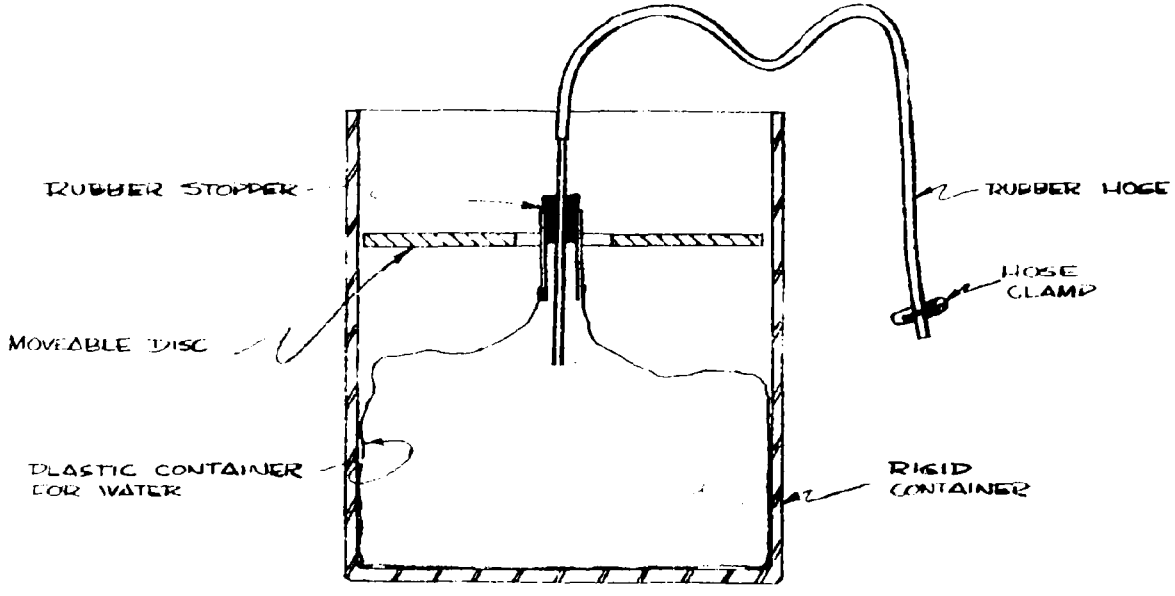
(4) Decanting Truck

Pouring, at its best, is awkward, and in inexperienced hands may well result in personal injury to the handlers, such as the development of a hernia, and the actual loss of water. It may be improved by the acquisition of a Decanting Truck which permits securing the container to the truck and tipping the assembly on rockers under one individual's very stable control. Where the number of occupants exceeds perhaps 100, the provision of such a truck is highly recommended. It is also needed in shelters devoted to women and children, such as may occur in schools. The extreme awkwardness as well as the slowness of this process, particularly in crowded areas, must be recognized, and suitable barriers or guards established to protect it.

(5) Distribution

It is desirable to have a larger container holding 8 or 10 cups which must be kept filled, and from which water can be dispensed, such as a pitcher which must be kept clean. With occupants on one side of the barrier, water is dispensed in 8 oz. cups full in either plastic

EXHIBIT B-27



METHOD OF WATER DELIVERY

or paper cups, preferably the latter for ease and sanitation. Best results will be obtained if the water container is elevated. For example, water in 17 1/2 gallon containers can be stacked two high and water can be delivered from the top container. In applying the initial force to deliver water into the tube, care must be exercised not to overstress the lower drum. In the case of five-gallon water containers, the water can be poured manually from the container into a dispensing pitcher, if available.

In any event, the following precautions should be observed:

1. Provide free space in front of the water container.
2. Exact care in providing equal portions.
3. Guard against any undue handling of water containers which might create a rupture with loss of water.
4. Make sure no water is lost.
5. Provide adequate reliable superintendance of storage.
6. Provide adequate nearby 'police' protection to prevent raiding of the water supply.
7. Insure as far as possible that air contamination cannot exist between water handlers and occupants or between occupants and water handlers. Insist, for example, that cups to be filled are placed on the counter and not held by occupants.

h. Recapitulation of Water Containers

FOOD SERVICE	17 1/2 Gal.	5 Gal.	10 1/2 Oz.
Is water in portions ?	NO	NO	YES
Can water be transported in original containers ?	NO	YES	YES
Can water be transported in portions ?	NO	NO	YES
Is water readily portioned ?	NO	YES	YES

3. Food

a. Packaging

Biscuits are in tins. The tins must be opened with a Class I, II or III opener (see Exhibit B-11) to prevent cutting the hands of food handlers and to permit subsequent handling of the tin as a receptacle for either human wastes or wastes from food service. The caloric contents of each biscuit and the number of biscuits to be delivered to each occupant should be known. In most cases, the number of biscuits to be delivered will not be equal to the number of biscuits that are packaged together. These packages will then be broken down.

Open the package on the counter and remove the required number of biscuits with as little manual contact as possible, isolating the required number from the pile to be delivered to the occupant. Proper use of the wrapping will insure a clean surface on which the biscuits may be placed and from which the occupant can pick them up. As in the case of the water, a counter should separate the server from the passing lines of occupants. If such a counter has not been provided erect a barrier of biscuit tins or cases of water containers. The

occupants must be made to pass this counter in an orderly manner and the server must be free to act.

Do not remove more biscuits from the tin than it is expected to be consumed, avoiding returning any biscuits to the opened tins. At the end of service, the opened tins should be kept under careful custody until the next meal time.

In the event that candies are provided in the Federal Stock, these should be portioned out as determined by the food manager. Such products are hygroscopic and so if shelter conditions are humid, care should be exercised that the container be kept closed as much as possible. This might require that candies be removed from bulk containers in reasonably large containers, for example, an 8 oz. cup or greater, and portioned to the occupants from such a container. Again, care must be exercised to prevent contamination by either the occupant or the food handler. For example, occupants may sneeze on the food. Hence, if no sneeze guards are provided as shown in the previous layout of equipment, the bulk dispenser should be as removed from occupants as necessary doing the portioning at the remote distance and deliver only the portion to the occupant.

b. Methods of Portioning

The number of candies furnished each occupant per meal will be of low order permitting fairly rapid count. If small bags are provided, the candies can be counted into the bags for delivery. Ask each occupant to save such bags if they appear to be in short supply. Provide tongs for handling. Bear in mind that there is no water

available for washing and that all hands are dirty (except food handlers who will dip their hands in a germicidal solution) so cross contamination is possible and should be guarded against. One method would be to portion into a number of bags (or cups) which remain the property of the food department. Their contents are delivered by emptying them into the occupant's bag or cup. This procedure will be satisfactory under conditions of low humidity, but may fail if candies are unduly sticky under some humidity conditions. Under worst conditions, if candies are very sticky they may have to be picked out one by one from the bulk container and delivered to the occupant's container by hand. This will be very unsatisfactory and a slow procedure.

4. Basic Federal Stocking - No Heating Facilties - Crowding

It is very conceivable that in the early time of shelter occupancy space crowding may be of such magnitude as to prohibit much in the way of formal service or regular meals. The water and food service stores have been located in the area of greatest protection, and consequently this area will be in the highest demand until radiation decay has occurred to such an extent as to permit moving occupants to less protected and possibly more remote areas. There exists a need, therefore, to issue water and food in terms of a daily ration, and to provide some means of transport. Women do not possess pockets, and may be encumbered by children or warm clothing. Bags should be provided. Federal stocking as presently planned makes no provisions for issues of water in anything than cups to which bulk water is delivered. To ease this particular situation, this report urges the storage of water in quart cans with can openers

attached. (Class III or V). Such a provision would not only permit relief of crowding but would also be a convenient way of provisioning people leaving the shelter to go to their homes after occupancy. Failing this, there seems to be no solution other than to distribute water three or four times a day with the attendant difficulties of almost continual overcrowding as well as unenforcable arguments relative to departures to less protective spaces. People should be urged so far as possible to bring water in significantly large containers or to even bring empty containers such as thermos bottles into the shelter to solve this situation.

a. Biscuits and Crackers

In most instances, these are bundled in approximately a day's caloric needs, and under crowded conditions, can be so delivered.

b. Carbohydrates in the form of hard candy

Candies will be in bulk, with twenty paper bags provided for issue. It is suggested that additional bags be provided to permit smaller delivered quantities than would result if the entire contents were distributed into the twenty bags, thus permitting, for example, delivery of small quantities at each meal time. Adequate space must be forced to issue these candies. Either a clean cup or scoop should be used.

c. Decisions

In all of these problems, considerable judgment must be exercised, and early decisions made by the food manager in the

shelter. This is a very difficult period, occurring as it does when organization is not complete, occupants are bewildered and disoriented and no prediction of either severity of attack or length of stay is available.

5. Distribution and Control of Water and Supplementary Food with Heating Facilities.

Space arrangement and the density of the population as well as the nature of the food supply will determine where and how occupants of the shelter are fed. When conditions permit, a special serving center near the food preparation and storage area away from toilet facilities, would provide the best arrangement. Such centralization may not be possible because of the nature of the building or the density of the population.

The need for a special feeding area will be minimized where the basic ration consisting of biscuits or crackers is the only food available. Under such conditions it will be possible to deliver packages of crackers as required to the group leader of the small units of 8 to 10 people and instruct him to pass them out equitably at the designated meal time. This will be especially desirable under crowded conditions. Where supplementary foods requiring facilities for heating or cooking have been stored, special equipment located at the food center is essential. Conveying cooked foods such as soup through a crowded environment would invite waste and increase the job of controlling rations and must not be contemplated.

At least some supplies of supplementary foods will be found in most shelters and pre-entry planning must take this fact into

consideration. Where heating is to be employed in connection with food or beverages, additional assumptions need to be made.

1. That space, light and energy to perform the operation exists.
2. That heat generated by cooking can be tolerated by the shelter.
3. That the staff has been pre-trained in the use and the limitations under which heat can be generated in the shelter.
4. That the heating of food can be done in cans.
5. That the heating of water can be done in an urn.
6. That throw away paper cups and spoons are available where the limited supply of water prevents washing.
7. That food can be consumed before spoilage, recognizing no refrigeration is available.

No change exists in the serving of Federal Stocking items, the additions of hot foods is the only new problem.

a. Hot Liquids - Beverages

The suggested procedure is to heat water only in the water urn. That is, no mixture should be prepared in the urn itself. This hot water will in turn be mixed in the occupants cups with whatever other ingredients are essential to the final product.

b. Coffee

For example, if coffee is the final product, a teaspoonful of dehydrated coffee will be delivered to the cup by the server, as well as a judged 1/2 fl. oz. of evaporated milk poured from the

original can container. (The server should reinforce his judgment by recognizing that 1/2 fl. oz. is equal to 2 tsp.) In addition, 1 tsp. of sugar, which is before the server in a cup, will be delivered to the cup. Hot water will finally be delivered from the faucet on the urn to a server's cup which will be inverted into the occupant's cup. Note that all possible precautions are taken to prevent any contact between the server's hands and the occupant's cup.

c. Soup

If soup is the end product, the unopened cans of soup will be heated and opened with a Class I can opener (see Exhibit B-11). These fluid ounces of soup stock will be labeled into a server's cup and delivered to the occupant's cup. In turn, four fluid ounces of hot water will be delivered to the occupant's cup, who will stir it and drink it. Subsequently, on another pass by the food service counter, 1 fluid ounce of water will be delivered to the occupant who uses this to "wash" his cup and drinks the result. Coffee may be served on one pass before soup or the reverse procedure may be used, provided that all occupants are treated in the same way. Arguments should be referred to the advising committee, who must understand the reason as being based on control consideration. From the point of view of cleanliness, probably coffee should be served last, and the 1 fluid ounce of cleaning water shorted from the coffee supply. In this event of course, 4 fl. oz. would be delivered to the soup. This is an old "day camp" device which many woodsmen will recognize. Because no opportunity exists to wash cups, it is important that food particles be removed as completely as possible.

d. Milk

Milk for children will be prepared in the same manner. An additional child's supply of milk has hopefully been provided. If not, some swapping will have to be effected between adults in the same group. Thus, for an extra biscuit which the child does not need the adult will give up his quota of milk for coffee. *

e. Other beverages

No other beverages in public supply seem to conform to requirements for foods. For example, cocoa is packed in paper containers which might not stand up well under long storage times. However, it is conceivable that such items might be brought to the shelter at the time of occupancy. Their preparation would be similar to coffee.

f. Hot Foods - Undiluted

A number of foods will be heated and delivered to the occupants without dilution. In this event, cans, as purchased** will be heated, opened and the contents spooned out. Recall that 2 tablespoons (level) equal 1 fl. oz. A spoon of known capacity should be used. The spoon can be dumped into the occupant's cup, using another spoon to scrape the first. Avoid striking the

* It is always possible that heating devices cannot be used for various reasons. Mothers are assured that young babies can be fed with cold (70°) beverages and are urged to bring disposable bottles, as sterilizing capabilities will be non-existent.

** Food in cans supplied by the manufacturer has already been brought to temperatures near boiling, and the can will not be ruptured by heating to 170° F. Some 'spitting' may be anticipated. Consequent care should be exercised in opening.

occupant's cup and contaminating the serving spoon. Serving spoons should be wiped clean and sterilized in proper solutions at the end and beginning of each meal. If they are laid down during a meal, they should lie on a clean piece of paper.

6. Supplemental Stocking - Heating Facilities - Crowding

Crowded conditions will not permit serving of hot foods. If a serving line cannot be established, hot food should be abandoned until crowded conditions can be bettered.

7. Supplemental Stocking - No Heating Facilities - No Crowding

This situation may exist either because no heating facilities have been provided or because shelter conditions may dictate that it is extremely unwise to supply heat to the shelter. Because the definition of foods suitable for the shelter includes a requirement of satisfactory palatability either hot or cold, essentially the same menus may be provided, with less acceptability, of course, but without undue hardship.

It is strongly argued that heating facilities should indeed be supplied as a morale booster, while an abandonment of hot food due to shelter condition should not detract from morale basically due to the fact that under such conditions hot foods will not be greatly desired. It has been pointed out previously that children can accept milk at room temperature.

8. Distribution

Distribution involves delivery of food from stores to consumer. Basically closely associated storage and preparation units accommodating from 50 to 100 people have been set forth. It would follow then that if many people are to be supplied, multiples of these units be established. It is concernable, however, that a central preparation unit for more than 100 might be desirable, providing for transport to other remote serving units. Such a concept should be discouraged, but in the event that such an operation is planned, a "Scheme for Water and Food Distribution in a Shelter" is presented. This is a flow chart which requires explanation.

The functions involved are storage, preparation, distribution and service, or in a different conceivable order. Storage, distribution, preparation and service. Each area where these functions are performed could conceivably be remote from one another. It is the purpose of the flow chart to define the conditions under which any product will submit to geographic separation.

9. Food Flow Charts

Areas

Area A is a food serving center designed to serve all individuals. The distance from storage to preparation to service may be equated to zero. It possesses heating preparation facilities.

Area B is a food service center at some distance from storage and heating preparation. It does possess cold preparation. Areas C, D, E are areas which might be assigned to small groups of 8 - 10 people. Water and food would be delivered through a group leader.

Definitions

Preparation - is the performance of any act on food other than that of portioning.

Various methods may be contemplated, depending upon the form of the water or food units. Several examples will be taken. On the chart, areas are shown by rectangles, actions by ovals, decisions by diamonds and end results by large circles. An arrow ⟶ denotes permission or yes. A small circle denotes a negative decision.

Example I

It is desired to deliver cold water in 5-gallon containers to Area A

Start from locked storage

a. Is product to be heated in Area A? No. Follow paths 2 and 4

b. Is product to be portioned in Area A? Yes. Follow path 6 and prepare and portion

c. Is product to be transported in multiple portions? No. Follow path 9 and serve.

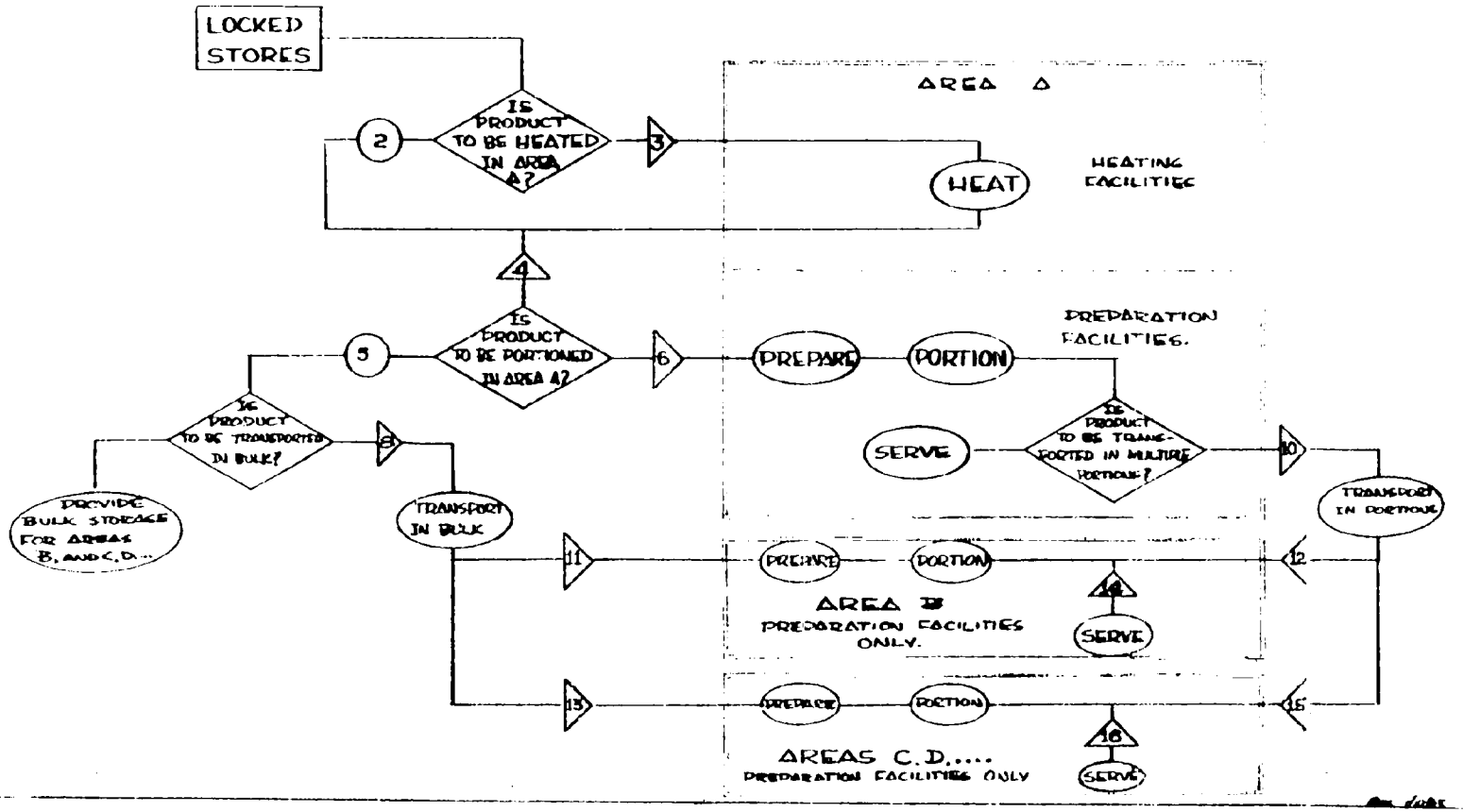
By the same process, water in five-gallon cans can be traced to any serving area where it is prepared, portioned and served.

Example II

It is desired to deliver cold water in 17 1/2 gallon water drums to Area B, C, and D ---------Paths 1, 2, 4, and 5 are followed, resulting in the question, "Is the product to be transported in bulk?" Since water in this quantity and form of container cannot

Exhibit B-28

ROUTING OF FOOD IN A FALLOUT SHELTER



readily be transported, path 7 is followed resulting in the conclusion that bulk storage should be provided for the desired areas.

General Conclusion A. Any product can be served in Area A.

General Conclusion B. Any item which can be heated, portioned and transported can be served in any area. However, no hot foods can be transported in multiple portions without many objections.

1. Transport requires some means of conveyance such as trays or boxes, which could be cumbersome.
2. Transport under crowded conditions results in spillage with resulting loss and unsanitary results.
3. Control is lost.
4. Theft is encouraged.

Undoubtedly, some transport will inevitably be employed, since some people will be indisposed and food will be carried to them, or young children will have food carried to them. However, this type of transport can be accomplished in unit portions with little of the attendant objection.

General Conclusion C. Any item which can be transported in bulk either hot or cold can be prepared, portioned and served in any area, providing facilities to prepare (can opener, for example) portion and serve are available.

Examine this situation - transport, except for water in large containers, is probably not difficult.

Area B

Area B is different from Area A only in that area A is

1. Close to stores
2. Possesses heating facilities

Area B may then be serviced in one of several ways.

Method 1 Supply Area B with water and transport all other products in bulk either from stores or from the heating facilities of Area A providing Area B with preparation and serving facilities.

Method 2 Supply Area B with water, transport all other products in the cold state, and provide Area B with heating, preparation, portioning and serving facilities.

Method 3 In addition to Method 2 above, provide Area B with its own stores, in which case Area B now meets the definition of Area A.

Of course, if heating facilities in any case must be adequate for the demands imposed upon them.

Provided no serious transportation problems are involved, Methods 1 and 2 are perfectly acceptable. They would be used over Method 3 only in the instance of complexity of providing heating facilities for Area B, which might be a question of available mechanical servers and ducts, or because the shelter occupancy might be an unknown factor so that more people might be unexpectedly taken care of in Area B.

Areas C, D - are considerably different from either Area A or B in that such areas would take care of small groups only. While such an arrangement might be desirable from a group morale point of view,

many problems arise. The first and perhaps the most significant is that exact portions cannot be issued to a group if supplementary foods are provided. Furthermore, hot water for beverages cannot be transported either in bulk or portions. It would follow, therefore, that if such areas were to enjoy hot beverages, separate heating facilities adapted in size to the group would be required, which even under ideal conditions has little to recommend it. However, where the menu is limited to Federal stocking items such a group distribution system can be envisioned for food, but not for water, unless water is in distributed units. Transport for multiple portions for these areas will be difficult unless helpers are provided, such as page boys.

10. Food Control

The tendency for people involved to take additional food in other disasters suggest the need for preventing cheating or stealing if possible through control systems. The most practical method of control is as follows:

As indicated earlier, all occupants are asked to form groups of 8-10 members with the understanding that this group relationship will persist throughout their shelter life. They are asked to elect a group leader.

At the time of the first formal service of food or water, the group assembles as a unique entity at the service area, and a food control deputy gives each member of the group a number such as I-3, indicating the third member of group I. This mark is placed on the hand of the group member with indelible pencil. The group leader is asked to identify and remember each member, recording

their names and group numbers if such accounting is possible. The recording of their names and group numbers and the total number in the group is recorded by the food control deputy. No assignment is to be made to an individual who already possesses an indelible mark, thus preventing an individual from becoming a member of two groups and so securing more than one issue of food or water. It is expected that the quality of the indelible marking will be such that it will persist long enough for the group leader to become familiar with the members of his group. In any event, the total number in a given group will be known and controlled by the food control deputy. The group itself, once established will reject any additional members, and an absent member who might be indisposed, will be taken care of by the group. If desired, the indelible marking can be renewed from time to time.

Summary

The method employed for serving water, food, or beverages will be influenced by crowding, facilities available, and the need for careful control of the portions distributed. While crowded conditions would suggest but one distribution of food per day, the danger of excessive misuse of the supplies through waste or barter create a hazard to be avoided. The water and food should be distributed as near the usual meal time as possible except as sleeping arrangements may require extended services.

Where basic Federal Stocking alone is used, the distribution of food will be simplified since it is appropriately packaged and can be served cold.

Method of dispensing water from the various types of storage vessels are described in terms of reduction of labor and maximum control. The packaging and portioning are described for supplemental foods where heating is involved with both crowded and less crowded conditions. Special consideration is given to various control systems to avoid the risk of a breakdown in the impartial apportionment of these critical supplies.

VII. SANITATION AND WASTE DISPOSAL

1. Types of shelter wastes
    a. Food
    b. General
    c. Medical
    d. Human

2. Procedures for food waste disposal

3. Human waste disposal

4. Sanitation

Summary

VII. SANITATION AND WASTE DISPOSAL

Maintenance of the general health level of shelter occupants is the joint responsibility of the shelter manager, the food manager, the medical director and the sanitation engineer.

Since preventative measures are more crucial than corrective measures, the correlation of hygienic food handling and the proper disposal of shelter wastes merits serious consideration.

1. Types of shelter wastes.

There are four general types of refuse material in fallout shelters, not varying greatly from normal sanitation classifications.

There are kitchen wastes - leftover food and liquids, used containers, wrappings and empty packages.

Second, general shelter refuse - cigarette butts, papers, floor dust and dirt, and discarded personal items.

Third, medical wastes - empty bottles and containers, discarded disposable supplies, wrappings, and bandages.

Last, human wastes.

Since medical waste disposal and general shelter sanitation problems lie within the realm of the medical and sanitation staffs, this section will be confined to procedures for the disposal of food and human wastes.

2. Procedures for food waste disposal.

The amount of time and attention demanded by the disposal of kitchen wastes will vary according to the type of ration served in the shelter. With the austere diet of water and survival biscuits,

food leftovers will be kept to a minimum.

Fiber drum water containers, together with the plastic bag liners, when empty of water, will serve as human waste containers. When full, the plastic liner should be tied securely and the container placed in a remote area. When it is safe to open the shelter door for even a brief period of time, the containers should be placed outside.

To save space, both the top and bottom of all cans should be removed and the can flattened. These may then be placed in the refuse containers.

With the addition of supplementary foods such as jams, peanut butter and cheese spreads, the number of empty containers would increase. Further additions to the menu in the form of soups, meats and stews would place added burdens on the food disposal workers.

No serious problem in storage space is anticipated, however, since refuse containers will require no more space than they originally needed.

3. Human Waste Containers.

The provision for human waste containers is much the same as above. Water drums with liners intact, as well as sanitation kits will be set up in the latrine areas. The liners will be pulled up and over the rims of the containers and the seat placed in position.

These sanitation kits, however, are 34 inches high, and would be uncomfortable for the average adult. It is recommended that a footstool at least 8 inches high be made available to correct this

condition. The footstool might be improvised, such as a carton or several empty biscuit tins fastened together.

Shelter planning in its entirety has been based on an estimated two week shelter stay. The federal government has provided a sufficient number of water drums and sanitation kits to serve as waste containers for this period, under the assumption that the ration will be only water and survival biscuits.

Various shelter tests have shown that drastic food curtailment under similar circumstances will result in less human excrement, both in volume and frequency of movements. It is not surprising then, to learn that constipation was a common complaint among shelter occupants, and that the frequency of evacuations during several two-week tests averaged 2.5 times per occupant.

If the austere ration is supplemented by spreads, or if the daily caloric intake is increased to 2,000 or more, it is certain that the number of waste containers will be inadequate as the number of evacuations per occupant will increase to near normal. Unless toilet facilities are available and operable on the premises, the disposal of human wastes will become a problem, especially after the first week in the shelter.

Again, holding to the assumption of a single nuclear attack and a maximum two-week shelter stay, levels of radioactivity outside the shelter should permit the door to be opened and the refuse material placed outside, after a few days.

If the radiological conditions resulting from a series of attacks do not permit even a brief venture outside after a two-week

period of time, the problem of waste disposal will seem insignificant when compared to possible death by starvation or thirst.

4. Sanitation.

With a voluntary food staff, training in sanitation for kitchen personnel is urgent. A list of rules and regulations should be posted as a constant reminder and should incorporate the following:

a. The kitchen and food service areas should be kept clean at all times. Floors should be wet-mopped to keep dirt and dust at a minimum and table surfaces wiped clean. If storage space in the form of cupboards is not available utensils should be covered with plastic or paper when not in use.

b. All kitchen help should stand hygienic inspection daily. Those with open wounds must keep them covered with suitable dressings. Those with colds or infections must be removed from service.

c. Food handlers must be instructed to wash their hands before going on duty and after using the latrine.

d. A hand antiseptic should be provided and used by every food handler before going on duty. Suggested is benzalkonium chloride, commonly known as zephiran. This is a mixture of alkyl dimethylbenzyl ammonium chlorides and is cationic. It is widely used as a germicidal agent in hospitals and doctors' offices. Diluted 1:1000 with water, it is effective as a hand disinfectant.

e. When toilets are near the food areas, they must be cleaned and well ventilated. No food should be stored in the latrine areas.

In larger shelters, health and sanitation problems will be under the direct control of the medical and sanitation staffs, but the preventative aspects of health would be the responsibility of the food manager. With limited water for cleaning, and restricted sanitary equipment, special training and extreme care should be undertaken by the food manager.

Flies, roaches, rats, mice and other vermin of all kinds thrive on filth. Careless handling of food in the preparation and servi .e areas would invite these unwelcome guests. Shelter occupants should be discouraged from hoarding food supplies and eating in their sleeping quarters. These areas should be inspected daily.

In the limited space of the shelter, good sanitation is not merely a matter of comfort, it may be a matter of life or death. Careless food handling as well as unsanitary latrine conditions, can spread such infections as typhoid, dysentery, food poisoning and diarrhea.

Summary

Preventative measures must be undertaken by the food manager directed toward the over-all health condition of the occupants. Garbage, empty food containers and debris must be taken care of after each meal by the kitchen staff.

The disposal of human wastes is the responsibility of the sanitation staff, which in turn, is dependent upon the food manager for guidance in the early stages of planning.

Refuse of any kind must be covered and disposed of as soon as conditions permit. Sanitation regulations are imperative and must be enforced, if a high level of health is to be maintained among the population.

ENVIRONMENTAL FACTORS

I. TEMPERATURE AND HUMIDITY

1. **Effective Temperature**
2. **Shelter Temperatures**
3. Summer Months
4. Overcrowding
5. **Detection of Danger**
6. **Winter Months**
7. **Humidity**
8. **Protection from Excessive Humidity**

SUMMARY

I. TEMPERATURE AND HUMIDITY

The problem of predicting and controlling the atmosphere in the shelter is a complex one, and a very serious one indeed, to which a number of competent individuals have applied their talents. Considerable literature exists in this field. It is not the intent of this report to even review this literature, but certain aspects of the atmosphere problem should be known to the food manager.

1. Effective Temperature

There is substantial evidence to indicate that when high temperatures (dry bulb) coincide with high relative humidity, a condition may be reached under which the temperature of the human body must rise because the heat produced by metabolism speeds in rate that which can be lost to the environment. This situation occurs at an effective temperature around 85 degrees for sedentary people. See "Acceptable and Tolerable Thermal Limits" Exhibit C-1. The consequences depend upon the degree of heat stress or rate of body temperature rise and the time of exposure.

The effective temperature is an empirical composite index of comfort or discomfort, involving dry bulb temperatures wet bulb temperatures and air motion, and is intended to describe what the human body feels about the combined situations. No measuring devices read in "effective temperatures", hence its values are available only through other measurements and the application of either a chart or a computation. Because of this somewhat complex relationship, it is possible for the dry bulb temperature to be higher than 85° if the relative humidity is sufficiently low, and still produce an effective temperature of less than 85°. Boundaries can be established. For example, an effective temperature of 85° exists if the dry bulb temperature is 85° and the relative humidity is 100%. Thus lower values for either measurement indicate an effective temperature of less than 85°.

ACCEPTABLE AND TOLERABLE THERMAL LIMITS FOR HEALTH PEOPLE AT REST, PROPERLY CLOTHED

Limits expressed in terms of Effective Temperature (E. T.) which is the temperature of saturated air with minimum air movement

Lowest temperature endurable in cold weather for at least two weeks in emergencies	35 degrees E. T.
Possible Chilblain, or shelterfoot	35-50 degrees E. T.
Lowest acceptable for continuous exposure Manual dexterity may be affected	50 degrees E. T.
Optimum for comfort, with 60% relative humidity	68-72 degrees E. T.
Perspiration threshold Acceptable for continuous exposure	78 degrees E. T.
Endurable in emergencies for at least two weeks Possible heat rash in prolonged exposures Some susceptible individuals may become casualties	85 degrees E. T.
Possible heat exhaustion in unacclimatized people	88 degrees E. T.
Possible heat exhaustion in acclimatized persons	92 degrees E. T.

EXHIBIT C - 1

2 Shelter Temperatures

Without air cooling, the shelter temperature and relative humidity may be higher than the corresponding outdoor conditions. See Exhibit C - 2.

The temperature and humidity existing within the shelter is a complex function of the number of inhabitants, what they are doing, the structure of the shelter, ground temperature, outside temperature air rates used in ventilation and others.

3. Summer Months

It is likely that without significant quantities of ventilation air per minute and in some instances the use of air cooling devices, shelters will be overcrowded in the summer months to the extent that dangerous conditions may exist.

The situation is important to the food manager. On the one hand, he cannot add heat and steam to the atmosphere to worsen an already precarious situation. On the other hand, he must take prompt measures to provision people to move somewhere else. (See Preparation and Service). To limit the caloric intake necessitates the people remaining highly inactive.

4. Overcrowding

Assume that under the existing conditions in the shelter a maximum of 50 occupants could survive. There are 75 occupants, however, whose total presence renders the atmosphere lethal, due to "overcrowding".

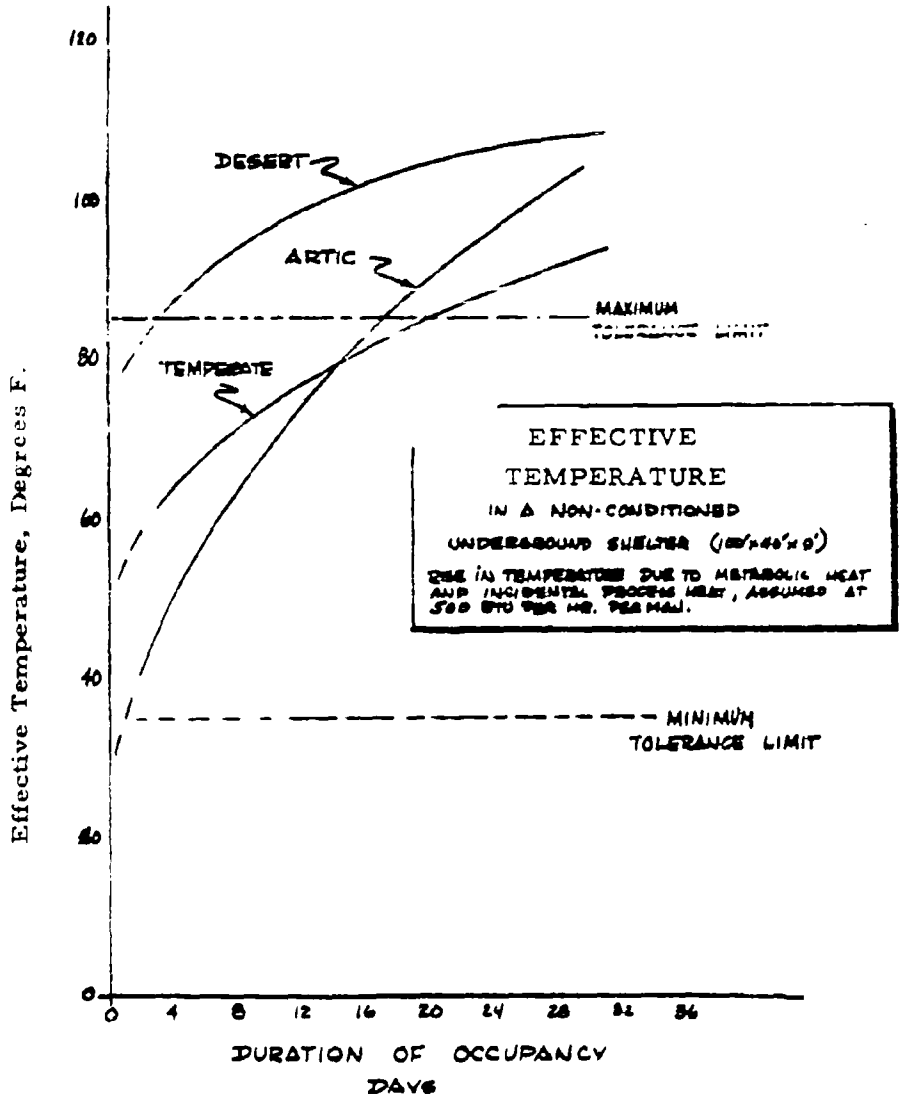
Overcrowding exists when the number of occupants present exceeds the number of occupants which the shelter will maintain under the existing conditions, which in turn, vary with the time of year.

If the 75 occupants remain, some will die, others will live. It is very probable that less than 50 will live. If the food manager and the shelter manager were able to make provision for 25 of the occupants to maintain themselves somewhere else under a lower protection factor, an excellent possibility exists for significantly more than 50 to survive.

For a short time during the year when temperature and humidity conditions are adverse, such "overcrowding" might well exist. The number of occupants assigned to a shelter is not evaluated in terms of this adverse situation, so that if 75 occupants are present in a shelter which is designed to house 75 occupants, "overcrowding" will exist.

5. Detection of Danger

The detection of dangerous conditions can be effected with instrumentation and knowledge. However, it is a complex measure and the correlation between the final effective temperature determination and the reaction of the individual is not precisely known. It is suggested that body temperatures of approximately 10% of the population be taken at half hour intervals when high effective temperatures are suspected to exist, and that a body temperature rise of 2° F. be accepted as positive evidence that action be taken to move more people to less crowded areas if such areas are available. The assumption is made, of course, that all available facilities for increasing the rate of ventilation have been employed.



CLIMATIC REGION	INITIAL SOIL TEMP.	WALL AREA PER MAN
DESERT	80°F	150 ft²
TEMPERATE	50	100
ARCTIC	20	60

6. Winter Months

In winter months, the situation is quite the reverse. If heating systems cannot be maintained operative, the shelter temperature will drop to extremely low and uncomfortable levels. People should be alerted to bring warm clothes. In a sense, overcrowding will be welcome. The food manager should provide the maximum of warm food if he has heating facilities and should increase the calorie content.

7 Humidity

Under some conditions which might prevail for a short period of time during the year, it is very probable that the humidity in the shelter will be high enough to result in condensation on many surfaces. Besides causing unhappiness on the part of the occupants, this dampness may be of such magnitude as to prohibit keeping any records. Under these conditions, the food manager must proceed as best he can. At this point, he will find that training and familiarity with his tasks will be of great benefit. If the inability to use paper does exist, it is all the more important that personnel has undergone previous training.

8. Protection from Excessive Humidity

The food manager is in a peculiar situation at this point. First, he must carefully protect those supplies which are adversely affected by humidity. For example, a tin of biscuits which has been opened must be protected. If some plastic material and tape has been provided, opened tins can be covered. As a last resort, they might be covered by an extra garment. If candies are available, they probably should not be opened under the circumstances unless food supplies are indeed low.

Secondly, if heating facilities are available, morale factors would suggest that hot food be prepared, while on the other hand, a contribution to the atmosphere of steam and water vapor resulting from heating water would worsen an already bad condition. It is probable that the advantage of hot beverages or food outweigh the increase of water in the shelter. In this decision area, it would be quite convenient to enlist the advice of the Advisory Committee, and inform the occupants.

Excessive humidity will create an additional problem for the food manager. If floors or horizontal surfaces are damp, occupants will be on their feet and extremely restless. Possibly the number of meals should be increased to provide additional activity, or the recreation committee may create a "party", provided no physical activity is involved.

SUMMARY

Humidity is best lowered by air handling equipment, so if such devices are available, both humidity and effective temperatures can be controlled. It is doubtful, however, that many shelters except those created especially for the purpose will possess air conditioning facilities, so that high humidities and in some cases, high effective temperatures must be considered as a calculated risk.

Humidity can be lowered by use of dehumidifying agents such as silica gel or calcium chloride, for examples. The use of such agents must be employed with caution, since one of the effects of their use is an increase in effective temperature. Thus, humidity may be decreased only during the situation where an increase in effective temperature does not result in discomfort. As a general safe rule, they should not be considered, though they can be used under the direction of an informed individual.

II. ODORS AND ODOR CONTROL

1. FALLOUT SHELTER ODORS
2. TYPES OF ODORS
3. ODOR CONTROL
4. VENTILATION AND ODORS
5. GENERAL PROCEDURES

SUMMARY

II. ODORS AND ODOR CONTROL

The problem of the presence of offensive odors in fallout shelters is certain to exist, but fortunately must be considered psychological rather than physiological.

While the human olfactory mechanism is extremely sensitive to very slight concentrations of odiferous matter, this sensitivity gradually lessens with the passage of time. People entering a closed room may be struck by a strong odor present which the occupants do not appear to notice. Residents of mill towns and localities where industrial fumes or chemical wastes prove obnoxious to visitors do not appear to be aware of such offensive odors.

1. Fallout shelter odors

In fallout shelters, there will be three major objectionable odors: body odor, odor of human wastes, and garbage or rubbage odors. The latter, of course, would not be present where basic menu of survival biscuits and water was in effect.

Other possible odors include medicinal odors, if there are sick and injured present, chemical odors, and congenital or "plant" odors. This "plant" odor is the damp, musty odor peculiar to certain basements.

It is not anticipated that cooking odors will present a problem, since food preparation, at best, will be predominantly the heating of pre-cooked canned goods.

2. Types of Odors

Since water supplies will be curtailed, it is expected that water will not be available for washing either the body or clothing. Frequent or even occasional clothing changes will be virtually impossible. Hence, body odor may prove to be the most offensive of all objectionable odors in fallout shelters.

The odor of human waste should not present a problem in licensed shelters, as commode chemicals are provided for by the federal government. The chemicals used act as a masking agent and are reasonably adequate. When full, the waste containers may be sealed and placed in a remote area. If possible, they might be placed outside the shelter entrance.

Garbage, which will consist in the main of empty cans and jars, should be placed in plastic-lined containers and sealed at the tops when full by tying the plastic bag. To conserve space, different sized containers may be placed inside each other before disposal. These containers may then be placed in a remote area or put outside the shelter.

3. Odor Control

There are four general types of chemical deodorizers available for use in fallout shelters (as well as other areas). The most common type is the masking deodorizer, found in many households. This is merely a strong, pleasant scent, usually dispersed by spraying from a pressurized can, and is in liquid-to-vapor form. Its effect is very temporary, and, being so short-lived, is not intended for prolonged use.

The counteractant deodorizer is a synthetic aromatic chemical satisfactory only when used with an 'antagonistic' odor. When two such odors are sensed together, both are greatly diminished and thus the offending odor is rendered less objectionable. The selectivity of the counteractant type makes it unsuitable for shelter use.

Chemical reactants are the newest type of air deodorizer and work by combining with particular matter in the air to form another compound which, in effect, neutralizes the objectionable odor. This type is non-selective and very efficient. It comes in pressure cans as well as in liquid form. The latter is added to water which is then used to wash the floors, ceilings and walls of a room. Its action persists up to twelve hours. Unfortunately, these chemicals are comparatively expensive and their use in shelters on a grand scale is not contemplated at this time.

Absorption materials have been used with varying success. These are mainly activated charcoal, silica gel, and activated alumina. They are more successful when used as a filter with mechanical ventilation.

Studies have shown[1] that activated cocoanut shell charcoal is the best material that can be obtained for use in air filters. Use of such apparatus is optional.

4. Ventilation and odors

It may be readily seen that odor control and ventilation are inter-dependent. Strong objectionable odors would seem less

1. Navy Civil Engineer, 2:13: 1961

noticeable if the air supply were changed constantly.

While it may be true that as little as 5 cfm. per person of outside air may suffice for most ventilation problems in a shelter, C. P. Yaglon and other experimenters have found that a minimum of 10 cfm. of air is required to keep odors below the threshold of annoyance. If a choice exists, exhausts should be located in areas designated for cooking and toilet areas.

5. General Procedures

The problem of controlling offensive odors in shelters can be simply solved if adequate equipment is on hand and used. In the absence of an operating ventilation system, deodorizers as described previously, should be used.

Floors should be mopped using water to which a disinfectant of the chemical reactant has been added. Usually two ounces of the sanitizer is added to a gallon of water. Care should be taken in selecting a compound in that sickly-sweet permeating odors are avoided. Occasionally, the odor of a disinfectant can be more objectionable than the original problem odor.

In addition to this "wash" method of odor control, it would be helpful to have several cans of spray deodorizers available for use as necessary. These may be placed in critical areas such as the first aid room, latrines, and sleeping quarters.

It is understood, of course, that this "wash" method of odor control would be possible only if water supplies were not limited.

SUMMARY

The problem of objectionable odors in shelters may range from a mere nuisance to one of great significance. In the least, offensive odors may prove annoying, but no more so than other phases of shelter life. At the other extreme, under conditions of poor ventilation, widespread sickness and injury, and crowded quarters, strong unpleasant odors may result in nausea, vomiting, loss of appetite, headache and general malaise, but not death.

In the absence of forced ventilation and cleaning supplies, methods of odor control would become strictly empirical.

III. LIGHTING REQUIREMENTS, SOURCES AND SCHEMES

1. COMMERCIAL AND STANDBY SOURCES
2. UNIT GENERATORS
3. BATTERIES
4. GAS LIGHTS
5. HAND-GENERATING FLASHLIGHTS
6. BATTERY-POWERED FLASHLIGHTS
7. CANDLES
8. GASOLINE LANTERNS
9. KEROSENE LAMPS

SUMMARY

III. LIGHTING REQUIREMENTS, SOURCES AND SCHEMES

One of the most basic needs in a shelter is light, from a morale standpoint if nothing else; but equally important to the handling of water and food. It is important that the food manager assures himself of adequate facilities to provide light as needed. This will involve a check on commercial facilities in the building, their reliability in a disaster, and possible substitutes should regular sources fail. The following schemes or devices seem applicable:

1. COMMERCIAL AND STANDBY SOURCES - There is high probability that usual utilities will be available, and lights customarily used will be employed. After the selection of a food service area, the shelter management should provide light sources to light these areas to at least 5 foot candles, and preferably 20. Other areas should be lighted also, of course, and the total lighting load should be determined in computing standby generator sizes.

2. UNIT GENERATOR - In the examples taken for pricing unit generators, a small allowance was made for lighting the food service area, but no provision was made for any other application. When the lighting load for a specific shelter is determined, the generator size should be increased by that amount.

3. BATTERIES - A battery standby unit can be provided. This is costly, particularly if enough energy is to be provided to last 14 days or 236 hours. A battery bank for this purpose should be designed by qualified engineers. Batteries should be inspected at least four times a year.

4. GAS LIGHTS - can be supplied from bottled gas. They produce high levels of illumination, and can be incorporated with the food service area if bottled gas is used for cooking.

5. HAND GENERATING FLASHLIGHTS - can be used as auxiliary lighting, but are extremely awkward for any permanent duty.

6. BATTERY-POWERED FLASHLIGHTS - have the same disadvantages as battery power. However, they can be used if enough batteries are available. The shelf life of batteries is in the order of one year.

7. CANDLES - provide a cheap long shelf life source, providing a reliable last resort type of lighting. Plumbers candles should be used. These are about 1-1/4" in diameter by 4-3/4" long, and will burn in still air for 5 hours. Because of their broad base, they require no candlesticks. They should be stocked in a cool location.

8. GASOLINE LANTERNS - produce satisfactory light but introduce an element of danger in the fuel.

9. KEROSENE LAMPS - if obtainable, may well be used, particularly if the cooking fuel is kerosene.

SUMMARY

Some provision for lighting must be made; it might be wise to pair the light source with the cooking fuel, equating candles to charcoal. In any event, an adequate supply of candles is suggested, as a safeguard against having to operate without light. (See Selection and Design of Equipment).

IV. SPACE ARRANGEMENT, ASSIGNMENT AND PREDICTION

1. STORAGE FACILITIES
2. SUPPLEMENTARY FOODS
3. SPACE FOR OCCUPANTS
4. ASSIGNMENT OF OCCUPANTS
5. SPACE FOR STORAGE
6. SPACE FOR FOOD SERVICE
7. SPACE AVAILABLE
8. CROWDED CONDITIONS

SUMMARY

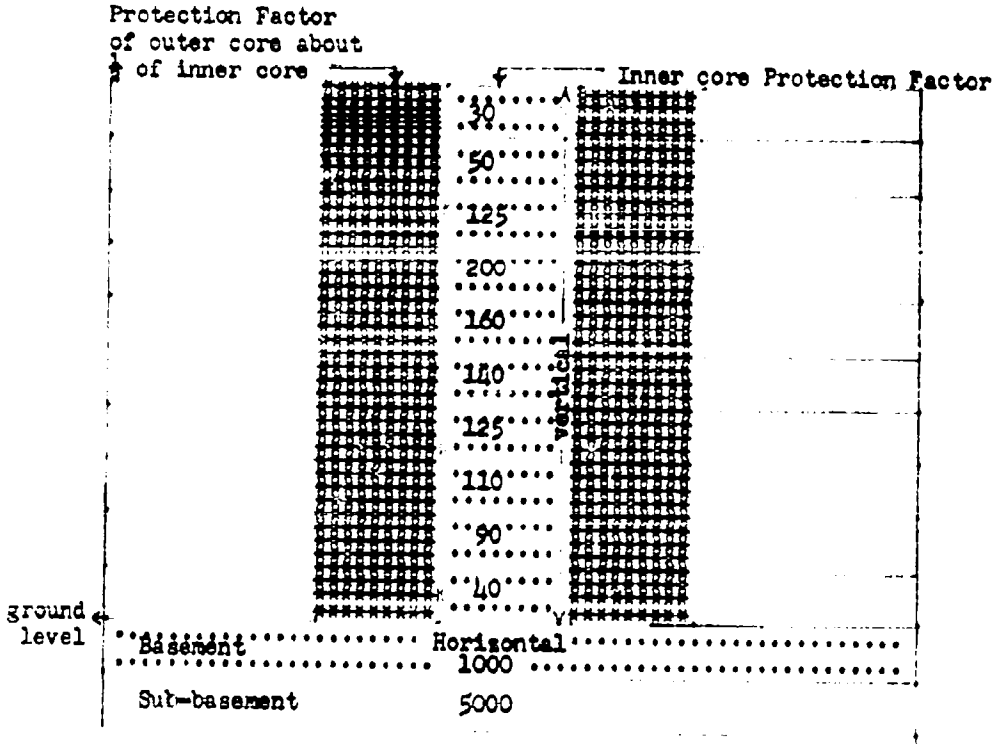
IV. SPACE ARRANGEMENT, ASSIGNMENT AND PREDICTION

One of the most critical factors in the management of food in the shelter is the problem of space. All essential operations must be planned for a minimum amount of space. Where the shelter consists of one or more rooms on the same level, it constitutes a horizontal shelter and permits a more economical use of space. On the other hand, where the space is distributed over two or more levels it may be thought of as a vertical shelter, and requires more space for equipment and storage of heavy materials. See Exhibit C - 5.

In the horizontal shelter, only one food center would be required to serve the one hundred occupants. This might demand less equipment and storage space than a vertical arrangement. In the vertical shelter, one center may need to be planned for each floor. This is particularly necessary where containers for 150 lbs. of water, as indicated in the Federal Stocking Program, are to be used.

1. STORAGE FACILITIES - In planning storage facilities in the shelter, consideration must be given to maintenance and replacement of the government provisioned supplies and equipment during the pre-occupancy period and to the security and convenience of them once the shelter has been occupied. Storage areas should be freeze-proof and dry and as near to the food area as possible. Water in 17-1/2 gallon containers can be piled two high, but higher stacking should be avoided if at all possible, because of the difficulty of access or handling. At a height of some 44" clearance to floor, shelves

MULTI-STORIED BUILDING*



VERTICAL AND HORIZONTAL SHELTERS

EXHIBIT C-3

* Nuclear Attack and Industrial Survival, McGraw Hill, 1962

should be installed on which biscuits and candies can be piled. Water drums should be piled with about an inch of space between two drums to insure that no undue strain is imposed on the container and to permit movement when the drum is moved out. The total weight for 100 Federal units weighs 3436 pounds and will pack into 19 square feet of floor space, producing a load of 180 lbs. /1 sq. ft., which may be beyond the permissible weight per square foot for many floors other than basements. Permissible floor loads, therefore, must be known before overloading is permitted. A possible storage arrangement is shown in Exhibit C - 4. for 100 Federal Stocking units. * Where feasible, shelving should be installed providing for the heavy containers of 70 pounds or more on the floor level and arranged above the floor according to weight. The shelves should be as shallow as possible to insure space and at the same time sturdy enough to hold packages weighing up to 50 pounds on the first shelf. In general, all supplies and utensils should be stored in protected places under lock and key or with break-glass access in the event the key is not available when needed.

2. SUPPLEMENTARY FOODS - Additional shelter space should be provided for supplementary foods in addition to the basic rations stored by Civil Defense. Unless well selected, supplementary foods may be less well packaged and more perishable requiring more space than the standard foods.

Much can be done to plan for the maximum utilization of available space when the feeding and sleeping requirements are met. If the

* A Federal Stocking unit is 14 quarts of water and 10,000 calories in biscuit or combined biscuit and candy form.

radiation factors at different locations in the shelter are known, low protection areas could be set aside for storage and issue of food and supplies and temporary storage of human and other waste. Where practicable, all required space for basic functions should be set aside before the pressure of occupants for personal space becomes acute. Once the density of the population is known, consideration should be given to traffic requirements for distribution of water and food.

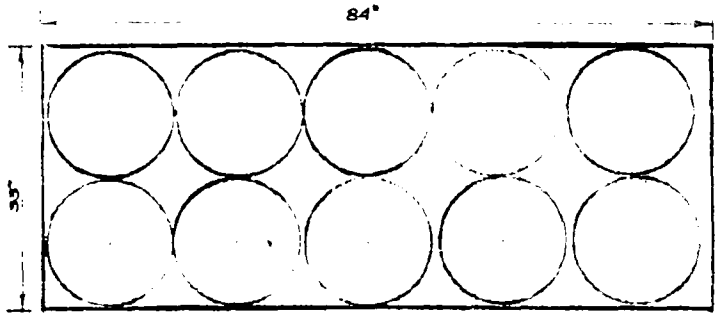
3. SPACE FOR OCCUPANTS - Previous observations in shelter experiments indicate that the pressure for space by occupants is very demanding. Each group is eager to occupy areas of greater protection or convenience. For this reason, it is important for the food manager to select and protect the areas he needs for his basic functions and storage in the pre-entry period.

With careful consideration for convenience and sanitary factors he should set apart one or more food areas. Tables acting as a cafeteria counter should be arranged around the food area in such a way as to provide a barrier to protect food operations. Curious children will otherwise crowd in around the food centers and impede operations or have accidents. Once these areas are set up, facilities for toilets should be arranged as far away from the food centers as possible. In the case of vertical shelters they could be placed on a different floor.

4. ASSIGNMENT OF OCCUPANTS - The number of occupants assigned to a designated shelter will depend upon the total volume of space and the facilities for mechanical ventilation. Where no

DESIGN FOR STORAGE
OF FOOD AND WATER.
FEDERAL STOCKING

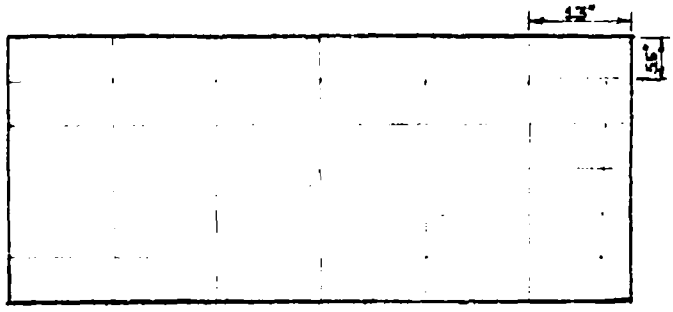
20 DRUMS 16" x 21"
72 BISCUIT TINS 13" x 8½" x 5½"



10 17½ GAL. WATER UNITS

20 UNITS TOTAL

TIERS 1 & 2

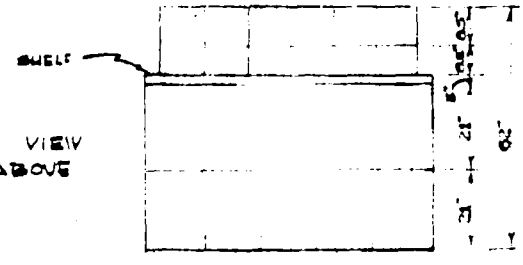


36 BISCUIT TINS

72 TINS TOTAL

TIERS 3 & 4

TOTAL WEIGHTS:



ELEVATION VIEW AT ½ OF ABOVE SCALE.

430 LBS.

3000 LBS.

WEIGHT PER SQ FT. = 180 LBS +

artificial ventilation is to be provided for, a ratio of 500 cubic feet per occupant is the formula used for setting the capacity. Where shelter space is equated to a 10 foot ceiling height, each person would have 50 square feet of space. If, however, adequate ventilation, such as mechanical fans and auxiliary power is available, each occupant is assigned but 10 square feet of space. This may be readily and accurately visualized as the space available to the individual in the table area of a crowded cafeteria. In the shelter, however, the person must sleep and live in this space in addition to eating. In early panic conditions following a disaster, or threat of one, the space per occupant may be reduced to as little as 2. 4 square feet per occupant, creating conditions comparable to those in an elevator.

Each one of these conditions will definitely influence the nature of the food service. In the 50 square feet per occupant situation, ample room exists for movement by the occupants and among them by the service staff. In the 10 square feet per occupant situation, food services can be readily conducted if movements of the occupants are highly organized. In the 2. 4 square feet per person situation, elbow room will be at a premium and water and food can only be passed out as packaged bundles without control. Such a condition will be highly unsatisfactory both from the point of view of the food manager and the occupants. It is highly probable that many, particularly in middle age, will seek to escape such a situation at the first opportunity and move to a less secure shelter if water and food can be made available to them.

Food service must plan to meet any of these situations with essential equipment and supplies. It is well within the range of possibility that a shelter possessing an adequately high protection factor is adjacent to spaces possessing lower protection factors. Since the radiation effect of fallout decays very rapidly, shelter areas possessing low protection may be highly satisfactory after a short period of time. If inspection shows this to be the case, overcrowding could be relieved by moving some of the occupants to such spaces.

5. SPACE FOR STORAGE - It has been demonstrated that stores will occupy something in the order of 19 square feet in a shelter capable of accommodating 100 persons. Roughing this figure off, it may be said that one square foot is required for each 5 persons. This same square feet assignment will accommodate food as well. It does not follow that water and food storage will preempt person space, since it is possible and desirable (though probably not practical) to range water and food stores along a wall providing bench space. It is further possible to rack food up on shelves out of the way, and if water were in small containers the same procedure might be followed.

6. SPACE FOR FOOD SERVICE - It appears that 60 square feet of space is desirable for food service feeding 100 occupants and that for 50 occupants, 30 square feet will suffice. Below 50 occupants, very little savings can be made, and probably when the number grows to 80, 60 square feet will be desirable. As envisioned, food service equipment is completely portable. Stowing in overhead areas

so that occupant space will not be endangered means that equipment can be used only when space permits.

7. SPACE AVAILABLE - It is of interest to pursue some kind of procedure to determine space available under given conditions, recognizing that it is not the function of the food service manager to concern himself with assignment of sleeping space, but it is justifiable to determine if the space he requires is available.

Approaching a 100-occupant shelter which possesses adequate ventilation (well in excess of 5 cubic feet per minute per occupant) and therefore assigning 10 square feet per occupant, let a few assumptions be made.

First determine the space required for

(1) Sleeping

(2) Standing

See "Dimensions - Average Adult Male"

Sleeping			
Side	10" x 68"	=	4.7 sq. ft.
Back	20" x 68"	=	8.4 sq. ft.
Standing	10" x 20"	=	1.4 sq. ft.

Then assume there are no tiers of bunks (worst condition) and that 1/3 or 34 of the occupants are sleeping, and the balance standing under crowded conditions.

Total space - 102 people x 10 sq. ft./person =						1020 sq. ft.
Space sleeping	34	x	8.4	=	285	
Space standing	68	x	1.4		95	380
Space with no people						640

Continued

Continued from previous page

Space with no people		640
Space for storage	19	
Space for food service equipment	60	
Space for toilet facilities	6	85
Loose Space 50% +	=	555 sq. ft.

It therefore appears that all space occupied by people could be increased significantly, and furthermore that all could sleep at one time.

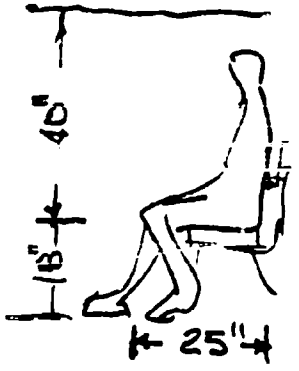
8. CROWDED CONDITIONS - All of the above considerations are correct if the shelter is occupied by the originally designated number, but it does not follow that this will be the case; rather there may indeed be significant overcrowding.

A number of strategies are available to meet this situation in which the food manager is concerned. A large percent of designated shelters are, or will be, contiguous to areas possessing a lower protection factor.

Strategy I - Under overcrowding condition, older people who would not expect to be damaged by slightly heavier doses could be induced to seek areas of lower factors if they could be supplied with water and food for an extended period of time, returning later to secure more water and food, or even taking turns with others in the lower factor area. This condition can be met if water is available in containers about quart size and food can be delivered in small portable packages.

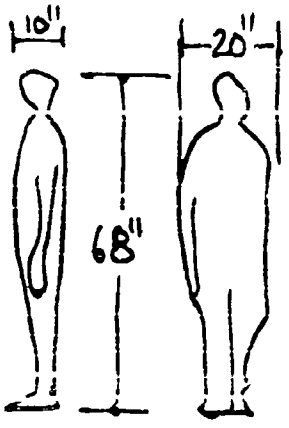
AVERAGE ADULT MALE

SOURCE GUIDEBOOK



SITTING OR LYING ON SIDE IN FETAL POSITION

400 IN^2 FLOOR SP.



STANDING OR LYING ON BACK OR SIDE IN EXTENDED POSITION

(2000 IN^2 FLOOR SPACE)
1.4 SQ FT

SITTING IN CRAMPED POSITION

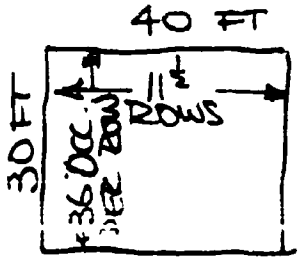
540 IN^2 FLOOR SPACE

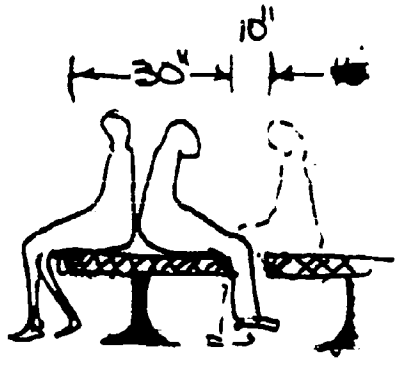
SOURCE: T. DEMARCO

EXHIBIT C-5

SEATED — COMFORTABLE

FOR MODEL 30X40





SHARED KNEE SPACE

$11\frac{1}{2}$ ROWS × 36 $\frac{\text{OCCUPANTS}}{\text{ROW}}$ → 414 OCCUPANTS

FLOOR SPACE PER PERSON = $\frac{40 \cdot 30}{414} = 2.89\ \text{FT}^2$

SEATED ON FLOOR (UNCOMFORTABLE)

A:

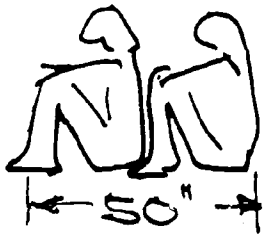
IN MODEL:

$8\frac{1}{2}$ ROWS × 36 OCC./ROW

→ 306 OCCUPANTS

→ 3.92 FT²/OCCUPANT

B:



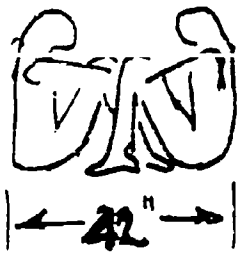
FOR MODEL

19 ROWS × 18 OCC/ROW

→ 342 OCCUPANTS

GIVES 3.50 FT²/OCC.

SEATED ON FLOOR



8½ ROWS × 24.2 OCC/ROW
(ROWS RUN OPPOSITE WALL)

→ 408 OCCUPANTS
GIVES 2.94 FT²/OCC.

LYING DOWN.

BACK:
(STAGGERED HEAD BY FEET)

7 ROWS × 18 OCC/ROW

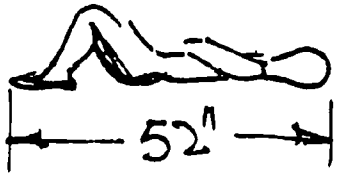
126 OCCUPANTS
9.51 FT²/OCC

SIDE:
(NOT STAGGERED — STRAIGHT OUT)

7 ROWS × 36 OCC/ROW

⇄ 252 OCCUPANTS
4.76 FT²/OCC.

BACK @ LEGS TUCKED:



7 ROWS IN 30' DIRECTION × 24 OCC./ROW.

168 OCCUPANTS
7.15 FT²/OCC.

SIDE @ LEGS TUCKED:

7 ROWS × 32 OCC/ROW

224 OCCUPANTS
5.36 FT²/OCC

Strategy II - Overcrowding in some degree can be borne for some period of time, but it is important to recognize the point at which it becomes dangerous (See Temperature and Humidity). When this point is reached it may be necessary to strongly induce occupants to seek lower levels of protection. A balance point may well be reached where a decision cannot be delayed too long, although it does not have to be made immediately. In this particular unhappy situation, the ability to predict the time a move can be made to an area of lower protection factor is of extreme importance. Such ability, with the proper instruments, does exist, and is shown in the appendix. "Dose from Fallout Radiation"

Further Advantages of Prediction - Food management must be ready to adjust its plans to a shorter period of confinement. Present opinion indicates the possibility of something less than two weeks shelter occupancy in a given fallout period. When such a condition can be forecast with confidence, the food ration can be increased and possible deprivation avoided.

The food manager must keep in mind that his shelter is pre-stocked for a given number of occupants who may have to be provided with at least minimum Federal rations for an estimated period of two weeks. It is also possible that much of the food in the homes, stores and fields may be contaminated, so that the occupants of the shelter may need to rely on shelter supplies after the confinement period is ended. The food organization must face these problems of adaptation of the limited food supplies, and it must utilize the

shelter period to inform the occupants of the problems of contaminated food and indicate how contamination can be reduced.

With instruments, information and know-how, the manager can make such predictions and be able to determine actions which will produce the best results for the most people. Prediction must be implemented for the shelter manager either from talent devoted to this at a control center and in communication with the shelter, or a simplification of the mathematics involved so that the manager himself may make such a determination.

SUMMARY

Space for critical operations as well as for occupancy by as large a population as possible requires careful planning. The arrangement of the floor space, the requirements for storage, the facilities for sleeping, the equipment needs and provision for services must be taken into consideration. Where supplementary foods requiring cooking are to constitute a major part of the food supplies, additional space for storage as well as for equipment will be mandatory.

Space for occupants will be tied directly to the ventilation system or lack of it, but whatever the assignment may be, it will be thought of as restrictive and create demands for more room by people who have been used to ample freedom and privacy in their private lives. The nature of the food service will be determined to a large degree by the amount of space per occupant in the shelter. Additional shelter space should be sought as soon as the protection factor is favorable, because of the many management problems caused by overcrowding.

APPENDIX

U. S. POPULATION BY RELIGIONS

Almanac

	TOTAL over 14	%
Protestant	78,952,000	66.2
Roman Catholic	30,669,000	25.7
Jewish	3,868,000	3.2
Other	1,545,000	1.3
No religion	3,195,000	2.7
Religion not reported	1,104,000	0.9
	119,333,000	100 %

EXHIBIT C-6

TOTAL POPULATION OF THE UNITED STATES - 1960

Ages	Males	Females	Total Whites
under 5	9.9	8.0	11.3
5 - 9	13.1	9.8	10.5
10 - 14	10.7	8.9	9.4
15 - 19	8.0	7.2	7.4
20 - 24	6.3	6.0	6.2
25 - 29	6.1	6.0	6.1
30 - 34	6.3	6.7	6.7
35 - 39	6.3	7.7	6.9
40 - 44	5.6	6.6	6.4
45 - 49	5.3	6.2	6.0
50 - 54	4.5	5.5	5.3
55 - 59	4.0	4.8	4.6
60 - 64	2.9	4.3	3.9
65 - 69	2.9	3.8	3.4
70 - 74	2.5	2.9	2.6
75 - 79	1.7	3.7	1.7
80 - 84	1.8		.9
84 - 89 and over	less than one	0	.5

Average Age is 29.5 years
82% of age 16 - 17 are in high school
97.5% White in New England
25.5% of White Males in the Northeast are married
29.7% of White Females in the Northeast are married.

EXHIBIT C-7

PERCENTAGE OF POPULATION IN LABOR FORCE
BY AGES IN THE UNITED STATES - 1960

Ages	Males %	Females %
14 - 17	[illegible]	15
18 - 24	[illegible]	43
25 - 34	[illegible]	35
35 - 44	[illegible]	43
45 - 64	[illegible]	[illegible]

EXHIBIT C-8

PERCENT DISTRIBUTION OF EMPLOYED PERSONS
BY MAJOR OCCUPATIONS IN THE UNITED STATES - 1960

Professional, technical and [illegible]	11.8%
Farmers and Farm Managers	4.0%
Managers, officials and proprietors	8.8%
Clerical and kindred workers	15.1%
Sales workers	7.5%
Craftsmen, firemen	14.2%
Operators	19.4%
Private household workers	2.3%
Service workers except household	9.9%
Farm laborers and foremen	2.4%
Laborers except farm and mine	5.1%
	100.0%

EXHIBIT C-9

EXHIBIT C-10

EQUIVALENTS

Grams Eq. Water	Tsp.	Tbsp.	Cu. In.	Gr. Oz. Eq. Water	Fl. Oz.	Cup	Lbs. Eq. Water	U.S. Gal.
3787.9	768	256	231	133.33 400/3	123	16	8.33	1
454.5	92.16	30.72	27.72	16	15.36	1.92	1	0.120
237.0	48	16	14.42	8.33 100/12	8	1	0.522 100/192	.0625
29.6	6	2	1.805	1.042 100/96	1	.125 1/8	.065	.0078 1/128
28.4	5.76	1.92	1.735	1	.96	.12	.0625 1/16	.0075
18.5	3.33	1.11	1	.578	.559	.0694	.0361	.004325
16.8	3	1	.904	.522	.500	.0625 1/16	.0325	.00390
5.07	1	.333 1/3	.303	.1735	.1666 1/6	.0208 1/48	.01085	.0013
1	.1975	.0596	.0542	.0352	.0338	.00422	.00220	.000264

2 tbsp. = 1 fl. oz. Jam = 1.408 gr. oz. 2 tbsp. cheese spread = 1.3 gr. oz. 700 tsp. sugar/gal.

FEDERAL SHELTER CLASSIFICATIONS AND SURVIVAL POTENTIAL

SHELTER CLASS	PROTECTION FACTOR	SHELTER EXAMPLE	FALLOUT DISPOSITION HEAVY	MEDIUM	LIGHT
1	20-39	basements of small bldgs. central areas, upper floors of large bldgs.	poor	fair	good
2	40-69	as above	poor	fair	good
3	70-99	OCDM basement fallout shelters	fair	good	good
4	100-149	as above.	fair	good	exc.
5	150-249	central areas of basements of large bldgs. with some exposed walls	fair	good	exc.
6	250-500	basements of large bldgs. with no exposed walls.	good	exc.	exc.
7	500-1000	as above	good	exc.	exc.
8	1000 up	underground installations mines tunnels, etc.	exc.	exc.	exc.

EXHIBIT C - 11

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